SCIENTIFIC AMERICAN

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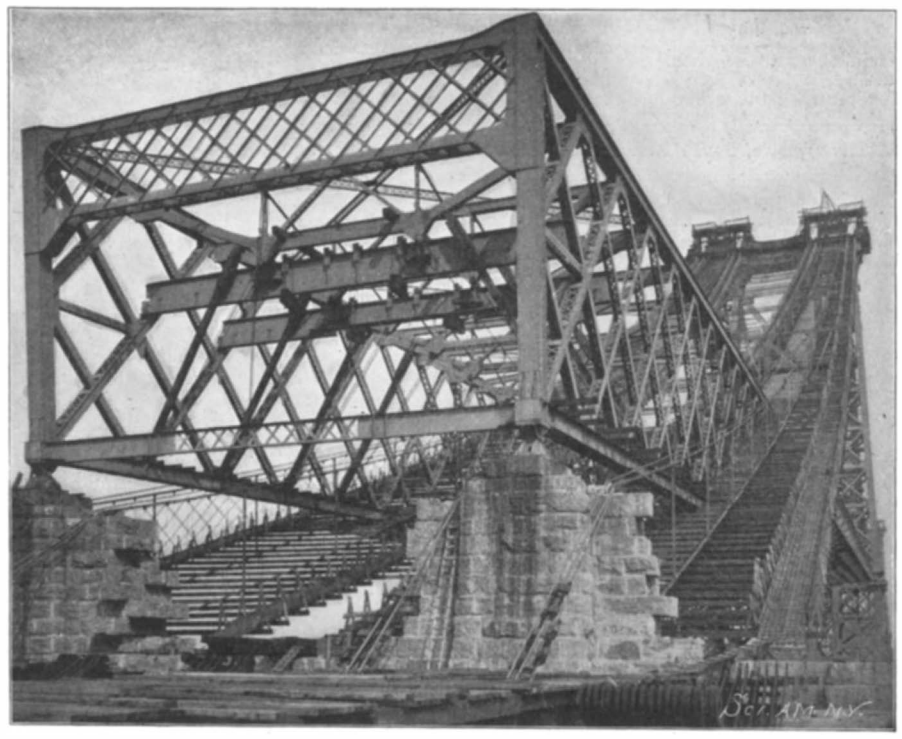
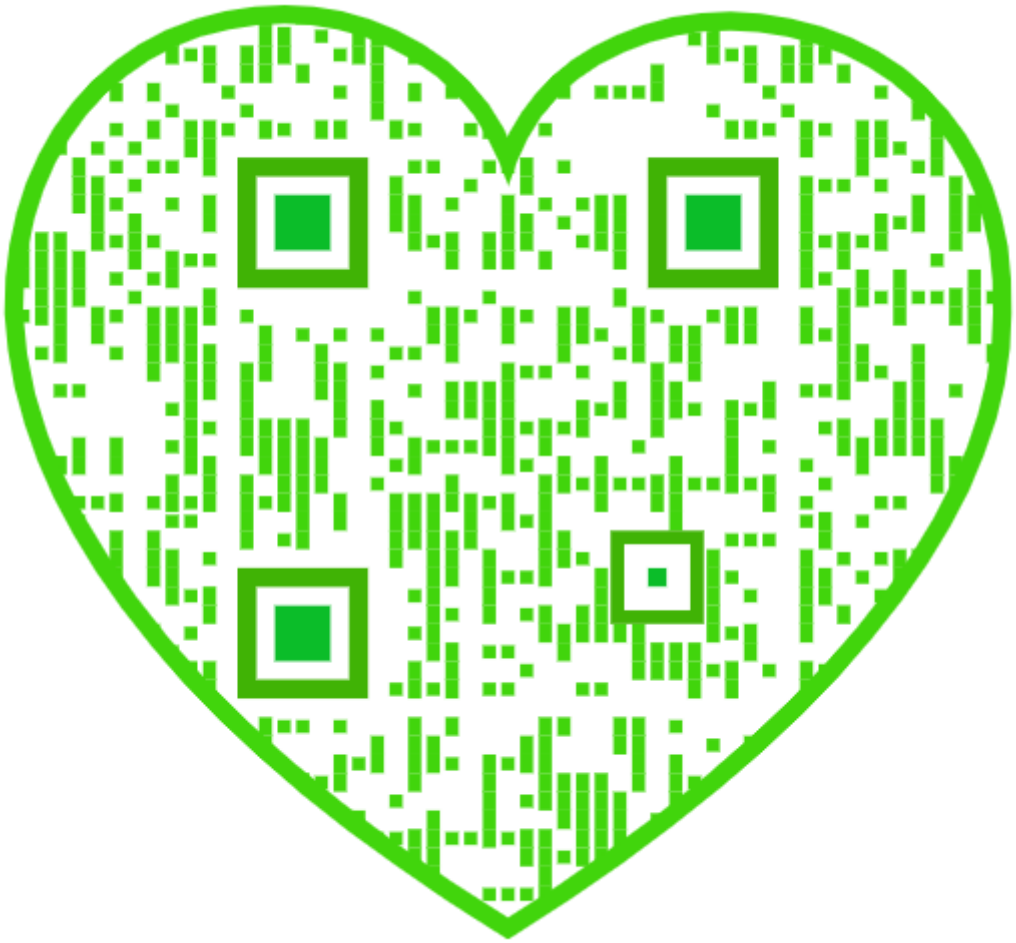
View from Manhattan Shore.



Looking Up Temporary Footways from Anchorage.

View from Top of Manhattan Tower.

FOOT-BRIDGES FOR TEMPORARY CONSTRUCTIVE USE ON THE EAST RIVER BRIDGE.—[See page 166.]



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NEW YORK, SATURDAY, SEPTEMBER 14, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE ATTEMPT ON THE PRESIDENT.

The country has been appalled as it has not been since the attempt upon the life of President Garfield, in 1881, by the news that a similar dastardly outrage has been committed upon the person of the President of the United States. It is difficult to comprehend how it is possible for crime of this character to be perpetrated, or even contemplated, in a country in which the institutions are free and the independence of the individual is paramount. The only explanation of such an act seems to be that there is disease prevalent in the land; that such an act can only be conceived by a disordered brain. The problem, therefore, which not only confronts the people of our own country, but that of other nations, is how to protect the individual head of the government, be he monarch or be he president, from the act of the unbalanced mind. It has been a notorious fact for a long time that a neighboring city is the hotbed of anarchism, and whether it is proved or not that the assassin is a member of this particular group of men and women is immaterial, so long as the fact remains that he is an avowed member of this despicable brotherhood. The professional anarchists in this country have almost without exception been of foreign birth. If the family history of the individuals forming this body of malcontents could be traced, it is probable that they would prove to belong to a class of unfortunates who have passed through generations of poverty, depravity, and perhaps oppression, with the result that they have, perhaps, inherited a bent of mind which is distinctly abnormal. It is possible, even probable, that such a bent would not be recognized by the psychologist, the medical student, or the alienist as a distinct form of mental disease. When the mind reaches the point of depravity at which it is unable to distinguish the difference between right and wrong—nay, more, that it mistakes wrong for right, even to the point of conceiving the murder of an innocent and unoffending individual to be an act of heroism—what further proof do we need of mental aberration?

It is against the spirit of our country and also of the times in general to curb or to punish the individual for holding opinions, even though these opinions may seem unhealthy, even dangerous. It has always been the policy of our institutions to allow freedom of speech in the broadest sense; that is to say, it has been our custom always to recognize freedom of speech in the *rational* being. If, however, a lunatic endeavors to incite his neighbors to murder or to arson, we cease to consider his act "freedom of speech," and we promptly place him out of harm's way within the walls of an asylum. Why not treat the anarchist in the same manner? He is equally dangerous to the individual and to the community. He cannot be restrained by fear of punishment, or even of death; he cannot be reached by the ordinary channels of reason; his mind is incapable of following the dictates of reason and arriving at a logical conclusion; his heart, in like manner, is hardened as against the ordinary human sympathies. By what channel, therefore, can this individual be reached? If this question cannot be answered, then why should he not promptly be treated as any other dangerous lunatic?

Such a course of treatment seems to appeal specially to our idea of common sense, for the anarchist is often consumed with vanity or filled with a love of notoriety, or with a desire to make his name immortal, or to pose before his neighbors as a martyr; in fact, there are many reasons which tickle his pride and make him willing to endure death in carrying out what he calls "his duty." But if such an individual were regarded in the eyes of the law as an ordinary lunatic and treated as such, and if the entertaining and the professing of such views as are ordinarily put forward by this peculiar sect were sufficient to stamp him as a proper subject for such treatment, surely the romance would soon disappear, and perhaps we would have discovered the speediest method of curing this loathsome disease. There is no difficulty in reaching the individual after the crime has been committed, but the disease is too serious in its nature to admit of our expecting a cure through any post-mortem treatment. The disease must be grappled with in its infancy. It must be strangled before the germ has been allowed to spread and attack the body politic. It is difficult to see how, therefore, the question may be met unless the anarchist is looked upon in the eyes of the law as the victim of insanity, and is treated accordingly.

"COLUMBIA"—TWICE A CUP DEFENDER.

The Challenge Committee of the New York Yacht Club, after witnessing a score of trials between the "Columbia" and the "Constitution," and as the result of a careful review of the respective performances of the two yachts in these trials, have reached the unanimous conclusion that the "Columbia" is better qualified, as matters now stand, to meet the very able challenging yacht, "Shamrock II."

This decision, although it was foreseen many weeks ago by all yachtsmen who have judged the work of the two boats dispassionately, will be the cause of keen disappointment to the public at large, who have become so used to seeing each new cup champion beat its predecessor that they will find it hard to accept the momentous decision of the Cup Committee without a murmur. Indeed, we notice that already one of the New York dailies has begun an agitation against the selection of "Columbia," and is thereby incidentally doing scant courtesy to the gentlemen who have given so much time and thought to the selection of a defender. Even if there were the slightest doubt as to "Constitution's" inferiority in her present form—which there is not—the mere promptings of decency should prevent any suggestion that the New York Yacht Club is sending any but its best boat against the challenger. We shall probably hear from the arm-chair critics at frequent intervals between now and the cup races; but we trust that they will fail to convince the American public that an editor sitting at his desk is a better judge of a yacht's performances than the committee of experts who have followed the boats over every course on which they have hoisted canvas.

A few prominent yachtsmen have been quoted, probably with no little inaccuracy, as saying that "Constitution" is the faster boat. It is likely that what they did say was that, if there were time to bring her up to pitch, she could be made a faster boat. In this we cordially agree; but as matters now stand, there is no time left for such experimentation, and it is rightly judged that such a thoroughly tuned-up boat as "Shamrock II." had better be confronted by a yacht of equally well-known capabilities, rather than by one whose performance is erratic and whose best speed may not be forthcoming when it is most wanted.

As a matter of fact, for the first time in the history of the cup contests, we, on this side of the water, are laboring under one of the many serious handicaps to which the visiting yacht has been subjected; for it is a certain fact that in the last four or five contests the cup challenger, for lack of time to make the necessary tuning-up tests, has come to the starting point a practically untried boat. The most erratic performance of "Shamrock I." in 1899 suggests that she was in much the same predicament as "Constitution" is now in 1901. It was realized on the eve of the races that her sail-plan was too large and her spars too light to hold it in shape; while the heavy lee helm which she carried suggested that the boat was badly out of balance. Had there been another six weeks available for making the necessary changes, there is no doubt that that boat could have been brought up to a pitch of excellence at which she would have made a very worthy competitor for "Columbia." Were a few weeks more available for the same experimentation with "Constitution," no doubt a similar improvement could be made in that boat. As it is, she is quite out of the question as a cup-defender.

As to the probable outcome of the races, we think that the cup is in very good keeping, and that the successful defense of two years ago may be repeated. "Shamrock II." has beaten "Shamrock I." by nine minutes on a 30-mile course, but "Columbia" has beaten the same boat by over ten minutes in the same distance. "Shamrock I." has been improved, it is believed, fully five minutes, over the cup course; but everybody who has watched the work of "Columbia" this season is satisfied that she also is several minutes faster than she was two years ago. We are able to state, on the best authority, that in light airs "Shamrock II." shows practically no superiority over "Shamrock I." and that it is only when there is some heart in the wind that she begins to pull away from the older boat. On the other hand, "Columbia" beat "Shamrock I." by over ten minutes, when the strength of the wind was only from 6 to 10 knots an hour. Hence, in light breezes which would enable the yachts to get over the course barely within the time limit of 5½ hours, we look upon "Columbia" as a certain winner. On the other hand, in breezes of 12 knots strength and over, we think that the extraordinary reaching and running qualities of "Shamrock II.," due to the great refinement of her form, will give her the race.

On the question of handling, we cannot see that there will be much advantage on either side. The masterly way in which the skipper of "Columbia" has sailed his boat in the present season proves him to be a worthy competitor against the celebrated amateur yachtsman who will sail "Shamrock II." off Sandy Hook.

A TIMELY WARNING.

The recent disclosures of the financial embarrassments of a certain famous liquid air company, which is just now very much in the public eye, prove that the persistent warnings which were given in the columns of this journal many months ago, when liquid air speculation was at its height, were fully justified by the facts. We pointed out at the time that the claims made for liquid air as a profitable source of power were based upon certain fundamental fallacies, which prevented this fluid from having much value or interest outside of the laboratory and the lecture room. In its present form as a prime mover, competing with the steam engine and the hydraulic turbine, it was doomed from the very first.

We are extremely sorry for those investors who have been caught by the alluring literature of the promoter, and are just now waking up to the fact that fat dividends are not to be distilled from liquid air. At the same time we believe that the prompt exposure of the underlying fallacies of some of the claims put forward in connection with the company which is now in financial straits has served the good end of preventing the investment of a vast amount of hard-earned money by that very section of the public which can least afford to lose it. Gratifying proof of this has come to hand during the past few days from several correspondents who have assured us that but for the explanation of the principles and limited commercial possibilities of liquid air given in our columns, they would have invested in one or more of the many wild-cat schemes which were floated by the professional promoters at that time.

TARGET PRACTICE AT ALDERSHOT.

An improved system for the purpose of developing practical musketry training has been adopted by the English military authorities at Aldershot. By means of ingenious targets electrically actuated, as near an approach as possible to actual warfare was obtained. The troops participating in the trials of the new apparatus were distributed upon one range of hills. On crests opposite, rattles of musketry were observed and along the skyline heads appeared and disappeared at regular intervals representing an enemy taking aim and firing. This afforded the target for the soldiers and discharges of musketry greeted the heads of the pseudo-enemy whenever they appeared. The attacking party then cautiously advanced toward the defended crests. Through the valley extended a railway which the enemy was zealously guarding. As the advancing foe reached the railway an armored train appeared and was subjected to a heavy fusillade. In its rear followed a cavalry patrol bent upon blowing up the line, and they were also subjected to a heavy rifle fire, completely riddling them, though they effected their object in the destruction of the line as the electrical explosion of a dynamite charge testified. The signal cabin to the right of the railway, which contained several men, was then riddled, and a farmhouse which concealed a large number of the enemy was also bombarded. Heads appeared at every window and a soldier presently ran out of the door with a gun. The soldiers continued their advance until arrested by a heavy fire from artillery concealed in a dense clump of trees. The effect of discharging shells was most cunningly contrived by the explosion of bombs near the dummy guns. The scheme was carried out by means of electric wires laid beneath the turf, and controlled by an engineer, who followed the movements of the troops by means of an arrangement of mirrors suspended over his head, in a butt. When the maneuvers had been satisfactorily carried out the targets were carefully examined, and it was discovered that the firing of the soldiers had been particularly accurate, many of the targets being completely riddled. Further experiments are to be carried out with this combination of electrical targets, and it is stated that they will supersede the old types, since it is found to improve the firing capacity of the men to a very appreciable extent.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

BY E. O. HOVEY.

The fiftieth meeting of the American Association for the Advancement of Science was held in Denver, Colorado, from the 24th to the 31st of August, under the presidency of Prof. Charles S. Minot, of Harvard University.

The meeting was well attended locally and regularly, and about 220 papers having a high order of merit were presented, some of which were of the greatest scientific interest and importance. Three hundred and five members and fellows were registered as being in attendance, besides the members of the nine affiliated societies which convened at the same time who were not members of the association, 92 of the number coming from the Atlantic States, 11 from the Pacific, and 6 from foreign countries. Fifty new members were elected, and 186 members were promoted to fellowship.

The chief interest of a convention is centered about the address of the retiring president, and it was with close attention that a large audience listened to Prof. R. S. Woodward, of Columbia University, who chose as his theme, "The Progress of Science," which will be found in full in the SCIENTIFIC AMERICAN SUPPLEMENT No. 1341. It is of unusual interest and importance.

The retiring vice-president of the section of anthropology, Amos W. Butler, State Superintendent of Charities of Indiana, chose as the subject of the annual address, "A Notable Factor in Social Degeneration," and discussed at length the effect upon the community of the presence in it of persons of feeble mind.

"The census of 1890 showed that there were more than 95,000 feeble-minded persons in the United States, but that they were not present in any uniform proportion in the various states. Whatever the proportion, such persons are a disturbing element in our social economy, and their life is a degenerating social force. Some of the children with stronger mental powers enter the public schools. They may make some progress for a time, but, whether they do or not, they must soon drop behind because they are unable to keep up with the work. Others roam the streets; the boys become the butt of the neighborhood, they are led into pranks, too often into vices, and seem to possess a peculiar tendency for immorality. The girls, many of them strong, well-appearing, with no one to teach them right and without strength of mind to protect themselves against the temptations which surround them, too early and too often fall into vice. These defectives usually become dependents for a part of, if not all the time. They may depend upon private charities, or, when possible, upon the overseer of the poor. They frequently live in the poorest quarters of our towns and cities, amid squalor and dirt, or occupy miserable huts in the least desirable localities of rural communities. It is not unusual for two or more families to live near each other or associate together. Marital ties are often lightly regarded. Frequently such bonds have not been entered into."

Prof. Butler cited statistics and related the history of many families of feeble-minded persons to show the effect which has been produced by our faulty manner of treating this unfortunate class of individuals, summing up his conclusions as follows:

"At last it became recognized that those who had given years of study to the idiot had a right to have an opinion and to express it. Then it came to be believed and advocated that in this class of defectives were many who were amenable to instruction, if it were only of the right kind and taught in the right way. The children might be reached and helped.

"First, it was thought many of these children could be educated to make their own way in the world. Finally, it was decided that while many of them could be taught to be self-supporting under direction, but very few could ever safely leave the fostering care of the institution. Children they are and children, mentally, they will be as long as they live.

"More and more came the conviction that there should be custodial institutions. These were especially advocated for feeble-minded women under 45 years of age. In such institutions they would be safe and with no prospect of reproducing their kind. Now it has come to be regarded as the proper right and duty to retain control over these grown-up children during life. Some states have made a beginning for this purpose. Never have we appreciated as strongly as we do to-day the untold misery and accumulating expense caused by the lack of control of our feeble-minded population. Their fecundity and animal instincts make them fit subjects for consideration, both on financial and moral grounds, to say nothing of the dangers that beset those of strong minds who have weaker bodies. The problem presented to us is the manner in which these conditions shall be met. Its solution lies in an intelligent and general knowledge of the subject by the public, preventive measures by legal marriage restrictions and other means, the education of feeble-minded children and the custodial care of feeble-minded women."

The cliff dwellers received a large share of the time of the anthropologists on account of the proximity of the ruins and the local interest in the subject. Mrs. John Hays Hammond, of Denver, gave an illustrated lecture upon some of these ruins, and Dr. J. W. Fewkes, of Washington, discussed the problem of their origin, and stated that the race which built them was not extinct. Prof. G. G. MacCurdy, of Yale University, reported for a committee that had been appointed to investigate the teaching of anthropology in the United States that it had been learned that there were thirty-one institutions in which the science was taught in some form. Dr. W. J. McGee, in a paper on "Current Questions in Anthropology," stated that the human race must have sprung from as many original pairs as there are or have been distinct races. By means of lantern slides from direct negatives, Dr. Fewkes described to the section and the public the snake dance recently held by the Moqui Indians for the purpose of inducing rain by placating the angered spirits of the air. At the request of this section the general association passed resolutions strongly indorsing the present movement to make national reservations of the chief areas of cliff dwellings, and urging upon Congress the early adoption of the necessary legislation.

Prof. C. M. Woodward, of St. Louis, in his address as retiring vice-president of the Section of Social and Economic Science, discussed the "Change of Front in Education," which took place during the past century, saying, in part, that "from the days of John Milton, in 1608, to the end of the eighteenth century, university training culminated in a preparation for the professions of law, medicine and theology, and in the training of the nobility for the duties and responsibilities of government and elegant society. But when alchemy developed into chemistry; when physics became an experimental science; when Leibnitz and Newton elaborated the infinitesimal calculus; when Watt invented an efficient steam engine; when Fulton built a successful steamboat; when Stephenson devised the locomotive and constructed a road with smooth rails; and finally, when Siemens and Gramme produced the electric motor, vast fields of fascinating and useful material were opened for study and research. Mathematical analysis and the principles of mechanics, which had previously been devoted to the problems of physical astronomy, were now directed to the study of the transformation and transmission of energy, the theory of structures, and the phenomena of electricity. The theory of evolution gave a new meaning to all vital phenomena; and the doctrine of the conservation of energy permeated all study of motion and force. Out of this vast extension of the horizon of human activity and a corresponding multiplication of occupations has come an imperative demand for more education and for technically educated men. In our industrial system the crying want has been and is for men who can both plan and execute. The secret of our unparalleled commercial and industrial success lies in the fact that we have put educated brains into our work. Hence a score of professions unthought of one hundred years ago have been called into being, and the standards of these new professions are of the highest order. And a university, instead of being 'a place where nothing useful is taught,' may now be defined as a place where everything useful in a high and broad sense may be taught."

Prof. C. R. Van Hise, of Wisconsin University, was designated by the association to give the public lecture in compliment to the citizens of Denver. He took as his subject "A Study of Ore Deposits," and gave the results of the years of investigation which he has devoted to the question of the alteration of rocks, as far as they apply to the deposits of the ores of metals. Prof. Van Hise believes that the greater number of ore deposits which contribute to the wealth of the world are the work of underground water; that is, that the solutions which permeate the rocks everywhere for a considerable depth below the surface are taking material in solution in one region and depositing material from solution in another, and that the material thus deposited in certain places is sufficiently abundant to make an ore deposit. The next fundamental principle is that the ores are derived from the outer crust of the earth. The strongest rocks are limited in their crushing strength, and at a certain depth below the surface of the earth the pressure will be enough to overcome this strength, if there is any opportunity for movement. Therefore, openings of great size cannot be assumed to exist below this depth, and it follows that veins cannot increase indefinitely in size and richness of metallic content as they descend. It has been determined by calculation, furthermore, that the extremely small percentage of metallic materials in the outer crust is enough in aggregate to account for all the deposits which have been or are likely to be mined. The third important principle is that the circulation of the underground water is due to the action of gravity on portions having different temperatures. Prof. Van Hise illustrated his points by the use of lantern slides and then proposed a new classification of ore deposits: First, those concentrated by ascending waters alone; second, those concentrated by descending waters alone; third, those concentrated first by ascending waters and then reconcentrated by descending waters.

Prof. T. C. Chamberlin, of Chicago University, in delivering what he modestly called a "Report on Some Studies Relative to Primal Questions in Geology," gave the Section of Geology and Geography the results of many years of patient investigation into some of the most abstruse problems of the science. He has found that the nebular hypothesis of Laplace and others cannot stand against the arguments arising from the mathematical consideration of the laws of mass and momentum and Prof. Chamberlin proposes to substitute for it the supposition that the nebula from which the solar system has been derived was disrupted by passing in its orbit close enough to a solid body to cause an explosion in the former. The fragments received a spiral or vortical motion, and may have thus formed the planets. This line of investigation indicates that the earth has been formed by the slow aggregation of attenuated matter with resulting comparatively low temperatures. If this hypothesis be correct, the earth is a solid spheroid, and most of the geological theories must be revised. The influence of these masterly investigations by Profs. Chamberlin and Moulton will be felt far beyond the domains of geology.

T. A. Rickard, of Denver, struck a popular chord in his earnest "Plea for Greater Simplicity in the Language of Science," which he gave before the geologists, but his paper could be read with great profit and his suggestions followed to advantage by many others besides scientists. He deprecated particularly the loose use of unusual words and of long, technical terms derived from Latin and Greek, when short Anglo-Saxon words could be used for expressing the same ideas. The author cited many striking examples of the harmfulness of this kind of pedantic language which obscures truth and falseness alike, to the degradation of science and the total confusion of those of the unlearned who are searching after information.

A new section, the tenth of the association, was organized at this meeting for the study of physiology and experimental medicine under the leadership of Prof. Cattell, of Columbia University.

The social features of such a convention were by no means neglected, and the association expressed its appreciation of the hospitality of the citizens of Denver, Boulder and Colorado Springs, which made this meeting memorable. The president for the ensuing year is Prof. Asaph Hall, of Harvard University, the celebrated astronomer, and the annual meeting is to be held in Pittsburg, Pa., from June 28 to July 3. The following year the experiment is to be tried of holding the meeting of the association during the first week of January, in Washington, D. C.

THE BEST CLASS TRADE PAPER.

Our esteemed contemporary, Printer's Ink, has recently established a competition to determine which is the best class Trade Paper. The competition has now been running for several issues, and we note that in its issue of September 4 the SCIENTIFIC AMERICAN is mentioned as having been dropped from further consideration on the ground that it cannot be called strictly a Trade Paper and therefore is not eligible to the competition. Our contemporary says:

"Among the papers dropped from further consideration is the SCIENTIFIC AMERICAN, without doubt the strongest and most influential of them all. It is the only one to which the American Newspaper Directory has heretofore awarded the mark of excellence generally spoken of as the bull's-eye (◎ ◎), the meaning of which is explained in the following paragraph:

"'(◎ ◎) Advertisers value this paper more for the class and quality of its circulation than for the mere number of copies printed. Among the old chemists gold was symbolically represented by the sign ◎.—Webster's Dictionary.'

"The SCIENTIFIC AMERICAN, however, never lets its circulation be known and is perhaps a paper of too much general interest to be properly denominated a class paper. Certainly it cannot be called a trade paper. Were the Sugar Bowl to be awarded to the SCIENTIFIC AMERICAN, it might, perhaps, be afterward claimed that the agricultural papers should have had consideration in this connection. In fact, it becomes apparent that the intention of the award is really not the best class paper, but the best trade paper. On this ground, if no other, the SCIENTIFIC AMERICAN is omitted from further consideration."

Under the patronage of the King of Belgium, a French-Belgian syndicate is being formed, it is reported, to build an electric express line for passengers and light freight between Paris and Brussels and from the latter place to Antwerp. The trip from Paris to Brussels is expected to be made in one and a half hours, and from Brussels to Antwerp in ten minutes.

THE NEW ATLANTIC LINER "KRONPRINZ WILHELM."

It is evident that the two leading German steamship lines are satisfied that there is profit in the building and running of high-speed Atlantic liners. The North German Lloyd Company, after several years' experience with the "Kaiser Wilhelm," which is capable of maintaining over 22½ knots an hour on the Atlantic passage, gave orders for two more high-speed vessels, both of which will be larger and faster than that ship. The first of these, which forms the subject of the accompanying illustrations, is a somewhat enlarged edition of the "Kaiser Wilhelm," and she is being equipped with engines and boilers that will give her at least a knot, and probably a knot and a half per hour, greater speed. The "Kronprinz" is 663 feet 4 inches in length over all, or 15 feet more than the "Kaiser Wilhelm"; her breadth of 66 feet is the same, as is her molded depth of 43 feet. Her normal draft of 28 feet 6 inches is 6 inches greater than that of the "Kaiser Wilhelm," and her tonnage is 14,800 tons, as against 14,349 tons, while her displacement is 21,280 tons, as against 20,880 tons. For the sake of comparison we give the dimensions of the "Deutschland," which is 686 feet over all, 67 feet beam, 44 feet molded depth, 29 feet draft, and 23,500 tons displacement. All three of these vessels were constructed at the Vulcan Works, Stettin, Germany, and there is now upon the stocks of this company a still larger vessel, to be known as the "Kaiser Wilhelm II.," which will have an overall length of 706 feet, a beam of 72 feet and a speed of probably not less than 24 knots an hour.

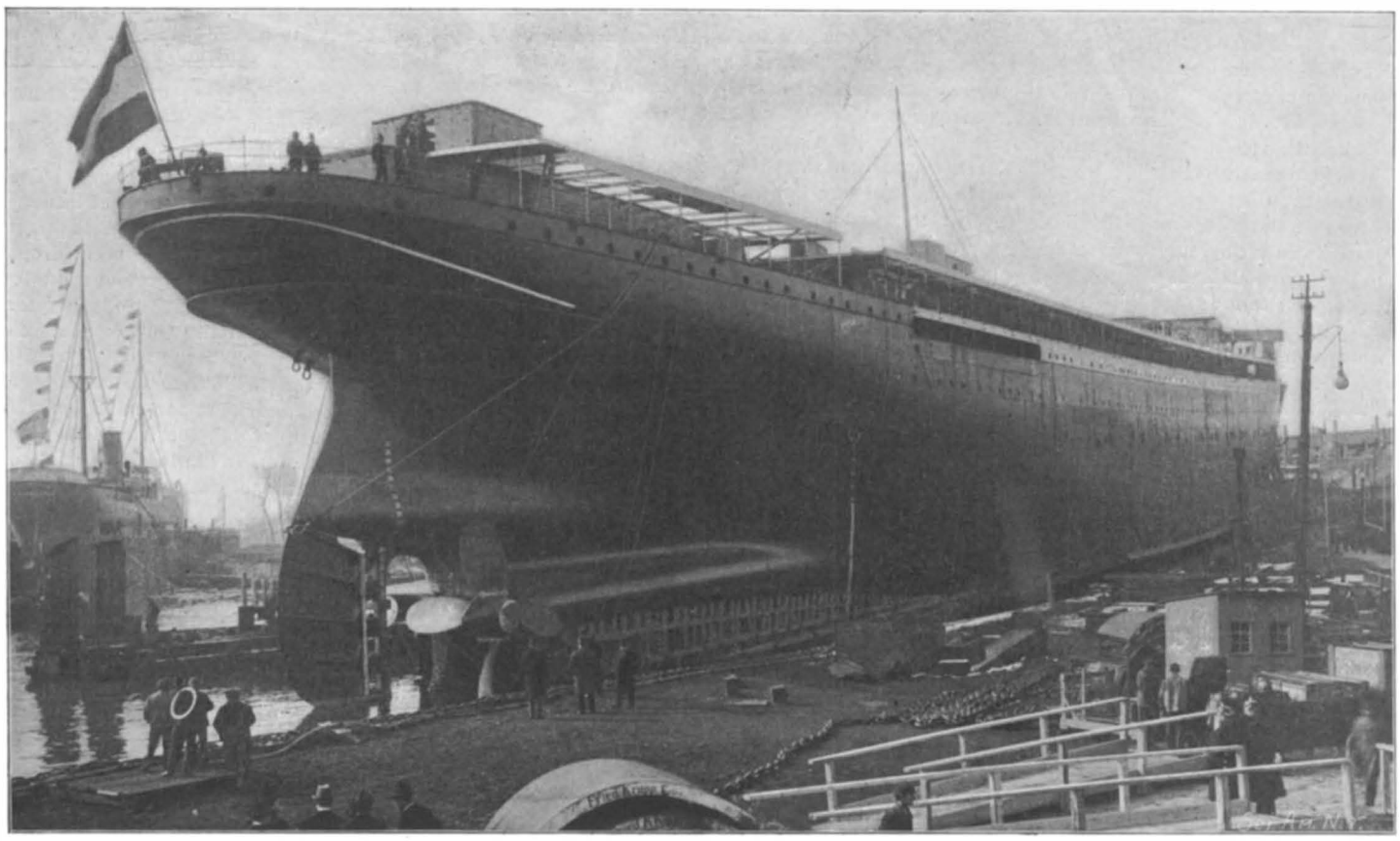
The Launch.

The "Kronprinz" is built of German steel, and while resembling in construction the "Kaiser Wilhelm," she embodies such improvements in the way of stiffening, subdivision, etc., as have been suggested by the experience that the company have had with the latter vessel in the Atlantic service. She is built with the usual double bottom, and the interior is divided by fifteen transverse bulkheads, which extend to a level considerably above the load-water line. There is also a longitudinal bulkhead between the twin engines. The bulkheads have been designed to withstand the hydraulic pressure due to any one of them being filled, while the adjoining compartment is empty. Safety is further assured by powerful pumps which can discharge 3,600 tons of water per hour.

In the decks and superstructure and in her general appearance the "Kronprinz" will be markedly like her predecessor. The poop is 115 feet in length, the bridge house 374 feet, and the forecastle deck 115 feet in length. The promenade deck is 508 feet long, and above this is a sun deck of the same length. The vessel provides for over 600 first-class passengers, 350 second-class and 700 third-class passengers, while the crew, including engine and boiler room staff, deck hands, waiters, etc., will total 525. As in the "Kaiser Wilhelm," the dining-room will be in the center of the ship, and will have accommodations for 414 passengers at one sitting. The drawing-room, reading-room, and smoking-room are on the bridge deck.

In connection with the provisions for safety, mention should be made of the fact that there are no doors through the water-tight bulkheads below the level of the water-line, and to enable those above the water-line to be kept closed at sea, separate exits have been provided from each compartment and from the spaces below the upper deck. The closing of the water-tight doors is regulated from the navigating bridge, where there is a chart which shows the water-tight compartment doors which the demands of navigation require to be left open.

The vessel is, of course, driven by twin screws, and the engines are of the quadruple expansion type, working on four cranks and balanced on the Schlick system, which has done such good work in other boats turned out from the Vulcan yards. The horse power will be about 33,000 with the boilers working at a pressure of 225 pounds to the square inch; but judging by the experience had with the "Kaiser Wilhelm," it is reasonable to expect that this estimated power will be largely exceeded in practice. The arrangement of the boilers is similar to that of the "Deutschland," there being four groups, in each of which there are three double and one single-ended boiler. There will be four smokestacks, the top of which will be 113 feet above the gage. The total heating surface is about 94,000 square feet, and the total grate area 2,691 square feet. It is expected that this vessel will make her maiden trip during the present month.



Length over all, 663 feet 4 inches. **Beam,** 66 feet. **Depth,** 43 feet. **Displacement,** 21,280 tons. **Horse Power,** 33,000. **Speed Estimated,** 23.5 knots.

THE NEW NORTH GERMAN LLOYD STEAMSHIP "KRONPRINZ WILHELM."

Mlle. Rodrigue has studied the structure of variegated leaves in a number of different plants. The white effect is due, in most cases, to the absence of chlorophyll, though a similar appearance is given also by certain dissolved pigments, and by the reflection of light from the cell walls. Where chlorophyll is absent the leaf may be regarded as diseased, and the tissues have a different structure from that of normal leaves, being much thinner and without any palisade parenchyme.—Bot. Gazette.

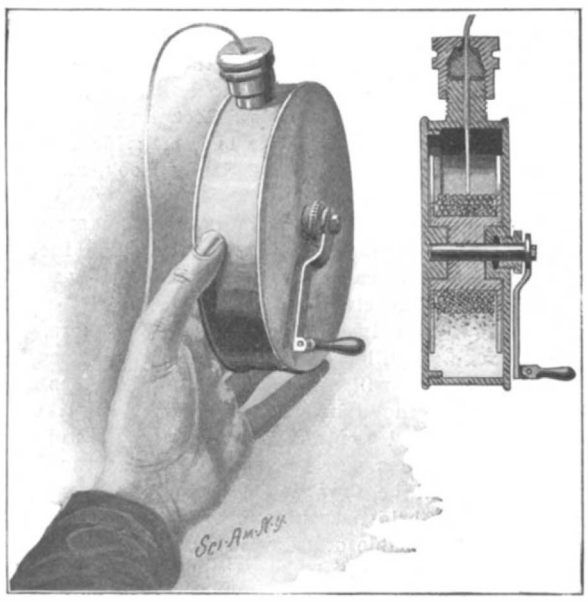
Flora of Madagascar.

The flora of Madagascar forms the subject of a paper lately read before the Académie des Sciences by E. Drake del Castillo. Of all the botanical region of the island the southwestern part is certainly the most interesting, and is probably that in which the flora present the most original types. The vegetation which covers that part of the island recalls, after the descriptions which have been made by travelers, the photographic views and the botanical collections obtained, the vegetable formations which have been observed in the western portions of tropical Africa. There, as in Madagascar, the plants send up a trunk of considerable height, with a crown of thin and rather straight branches, or on the other hand grow in bushy form at a short distance from the ground, with branches interlaced in an inextricable disorder. The vegetation is generally covered with sharp thorns or has a swelled and fleshy tissue which affords a water reserve. The leaves, generally reduced in number and dimensions, make only a short appearance on the branches. The period of flowering is short and in many cases only appears at long intervals. A group which belongs especially to Madagascar is that of the *Didierea*. These curious plants were described for the first time by Baillon; their classification remained doubtful for a long time, but they were finally placed by this author among the *Sapindaceæ*, of which they constitute a somewhat irregular type. The first of these, which was called *D. madagascariensis*, was found by Grandidier in the neighborhood of Tulear, and the second by Grevé near Morondava (*D. mirabilis*). In this group must, no doubt, be placed the four plants recently observed by M. Alluand. The first of these, which the author proposes to call *Didierea* (*Alluandia*) *procera*, is known to the natives as "fantsy-olotra," or thorny-skin. It is a tree bristling with thorns, thin and tall, sometimes reaching more than 50 feet, according to reports, and with but few branches. It has the appearance of an immense candelabrum. The leaves, at whose base are found the thorns, are but few in number and small (0.4 to 0.6 inch), of an oval form and fleshy in character. The male flowers, about ¼ inch long, are carried at the ends of the branches in ample bunches, often from 8 to 12 inches long. Another species is that known to the natives as the *Songo* or *Sonombé*. It is smaller than the preceding, and its branches, thorny and ascendant, come out at a shorter distance from the ground. It is proposed to call it *D.* (*Alluandia*) *ascendans*. The third species has a straight trunk which only reaches about 6 feet in height and is crowned by an irregular mesh of small branches. The leaves resemble those of the preceding species; the male flowers are smaller than those of the other *Alluandia*. This species may be known as *D.* (*All.*) *comosa*. The most singular plant is the fourth species, *D.* (*All.*) *dumosa*, which has the form of an oblong bush about 6 feet high, which branches out strongly from the base upward. It is not provided with thorns like the others, but the young branches are of a fleshy character and about the thickness of the little finger. The leaves have not been observed, as they seem to fall off at an early period. From a structural point of view the *Alluandia* present great analogies with the *Didierea*, properly so-called. In both cases may be observed, in the body and outer covering, vessels filled with a coloring matter of a red-brown color.

AN IMPROVED CHALK-LINE HOLDER.

In the accompanying illustration a chalk-line holder is represented which is of such construction that either a liquid or a solid may be employed to mark a line. Mr. Harry H. Wilson, of Nasel, Wash., is the inventor of the device.

The holder consists of a cylindrical casing, one head of which is integrally formed with the casing and the other removably secured in place so that the contents of the holder may be readily removed and cleaned. Within the cylinder a reel is mounted to turn, the line being wound around the reel in the usual manner. Upon the body of the holder-



A CHALK-LINE MARKER.

casing a threaded nipple is formed, upon which a cap-nut is screwed. Within the cap-nut a packing-block of gum is fitted. As our sectional view shows, the side wall of the bore in the cap-nut is conical in form; and the gum packing is similarly formed. The end of the line is passed through the nipple, packing-block and cap-nut.

To prepare the line-holder for service, the removable head is detached and a sufficient quantity of chalk is introduced within the casing. The removable head is then screwed back in place. The direct contact of the line with the chalk is sufficient to coat the line profusely. When the line is drawn out through the nipple, the gum-packing block will remove the excess of chalk, thereby preventing waste and enabling the line to make a better impression upon timber than would be possible if the line were too profusely coated.

The construction of the holder-casing is such that a water-proof liquid can be used instead of chalk; for the removable head when screwed into place is water-tight. If a liquid be used, a proper adjustment of the cap-nut will remove excessive moisture as the line is drawn out.

THE LOSCHWITZ SUSPENSION RAILWAY.

This new mountain railway was open to traffic May 6, and is the first of its kind for the conveyance of passengers. It runs from Loschwitz, a village on the banks of the River Elbe, about five miles from Dresden, to the top of the Rochwitz Heights, which command a most beautiful view of the Saxon capital. The railway is 820 feet long, and the grade is 32 per cent. It is constructed on the Langen system. The railways are carried by 33 hand-piers of varying sizes, the tallest being 49 feet high. Each car holds 50 passengers and weighs, when occupied, nearly 13 tons. Their shape and construction differ entirely from all other railway cars, even those used by the Barmen-Elberfeld Suspension Railway. The two trains of cars are connected by a steel cable 1.7 inches in diameter, and they are moved back and forth by two engines of 80 horse power each. Safety appliances are numerous and efficient. Visible and audible signals serve to regulate the arrival and departure of the trains, and these signals are operated both from the upper and lower stations. Each car is provided with a danger signal apparatus consisting of an alarm and a telephone which enables the conductor to communicate from any part of the road with the engine house. The car is provided with three brakes, two of which work automatically at the least slackening of the tension of the cable and stop the car. An indicating device in the engine room shows at all times the exact position of the cars, and a bell warns the attendant if the train is running too fast. An automatic brake, both at the top and lower station, is put into action by the arriving car, and stops it even if the engineer is careless. A round-trip ticket costs less than 6 cents; the journey requires only 3 minutes, and 15,550 passengers can be carried each way per day.

M. Santos-Dumont's New Balloon.

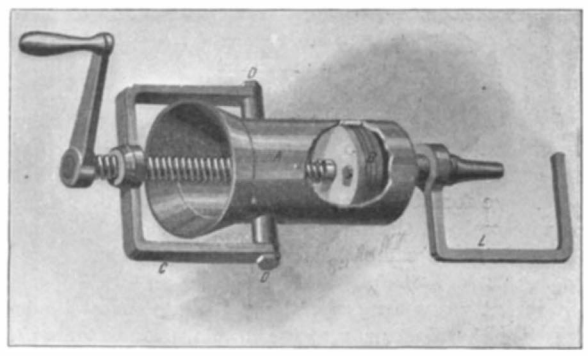
M. Santos-Dumont has been trying experiments with his new "Number 6" balloon. He proved that it had remarkable maneuvering qualities, but the new envelope seems to leak gas.

It is estimated that the cost of the food stores on the Antarctic supply ship "Discovery" amounted to $25,000. The supplies included 6,000 pounds of soup; 7,000 pounds of fish of all sorts; 16,000 pounds of roast, boiled and corned beef and mutton; 42,000 pounds of other meats; 4,500 pounds of ham and bacon; 11,500 pounds of vegetables, and 9,000 pounds of concentrated foods; 6,000 bottles and 4,000 pounds of dried fruits; 6,000 pounds of cheese, 42,000 pounds of flour, and 30,000 pounds of biscuit. There are also luxuries, says The New York Sun, such as real turtle soup, Devonshire cream, 10,000 bottles of champagne and spirits and wine, and 1,800 pounds of tobacco.

A GREASE-PUMP.

The introduction of grease of firm consistency into the oil cups and oiling holes of heavy machinery with the ordinary hand-pump is attended with some difficulty, especially in cold weather. Our English contemporary, The Iron and Coal Trades Review, recently published an account of a pump or syringe to facilitate such lubrication, to which we are indebted for the following description:

The pump consists of a bronze cylinder, *A*, furnished with a pointed nozzle in which a leather piston, *B*, can be moved up and down, by means of a screw-spindle. The screw at its upper end is furnished with a handle and it is guided by the stirrup, *C*. In order to fill the grease pump the piston is screwed out of the cylinder, and together with the stirrup, which moves around the fixed points, *D D*, is pushed



A SIMPLE GREASE-PUMP.

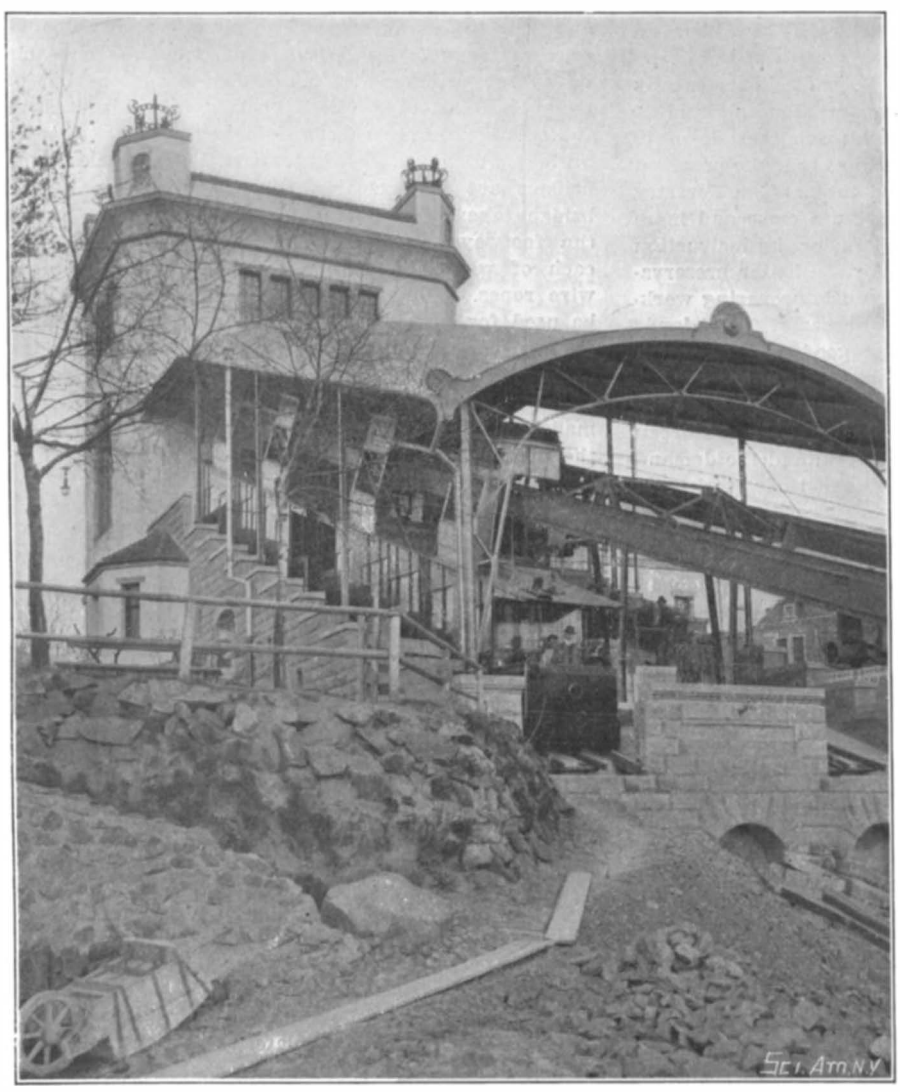
on one side. The angle-piece, *L*, is screwed on to the cylinder and serves to hold the pump on to the axle box. If, on the other hand, it is desired to lubricate hollow axles, the angle-piece, *L*, is screwed off and the nozzle inserted in the hole in the axle.

New Lamp for Lupus Cure.

Dr. Sophus Bang, manager of the laboratory belonging to Prof. Finsen, inventor of the light cure for lupus, has constructed, says a cable dispatch to the New York Sun, a special electric lamp, giving a feeble light, but which is extremely rich in chemical rays. The dispatch adds that Dr. Bang used metal instead of carbon poles. The bacteria-killing power of this lamp is ten times as great as that of an ordinary arc lamp, and a lupus patient requiring seventy-five minutes' treatment with the arc lamp will require only from three to five minutes' treatment with the new one, which costs only $15.

Test of the Roze Airship.

M. Roze made an ascent in his dirigible balloon at Argentueil, September 5. He reached an altitude of 65 feet and then descended. He found that his motor was too heavy and expects to make other trials at once.



SUSPENSION RAILWAY AT LOSCHWITZ, SAXONY—A TERMINAL.

THE LOSCHWITZ SUSPENSION RAILWAY—A CAR EN ROUTE.

Correspondence.

A Name for the Aborigines.

To the Editor of the Scientific American:

Only recently I saw an article from your magazine on the subject of a suitable scientific name for the aboriginal tribe of America, considered as a whole. It seems to me that the proposed term *Amerind*, formed from the leading syllables of "American Indians," now erroneously used, has the same objectionable feature that the latter expression has. Would it not also "perpetuate an error"?

I venture to suggest that the word Westmen could be applied to all the races inhabiting the Western Continent before the advent of Europeans. The adjectival form would be Westmenic or Westmenian.

Mary Isabel Smithson.

East Orange, N. J.

The Biltmore Forest.

by george e. walsh.

Private forests in the United States are not all conducted on the wasteful plan of converting the available commercial timber into money without consideration of the future supply. Some of the earliest attempts to conserve forest interests were made by private owners, who realized that successful timber culture should be placed in the same class with corn or wheat growing.

In recent years owners of large private forest lands have been the most progressive in adopting systems of forest culture which would increase the value of the woods. Dr. W. Seward Webb owns a forest tract in the Adirondacks where extensive forestry culture is carried on successfully. As the greatest danger in the Adirondacks comes from fires, the owner of this tract has established a system of fire protection, the most complete in the country. The tract is divided up into four sections, and an experienced woodsman watches over each section. The houses of the forest rangers are all connected by telephone with the superintendent's, and should a fire break out in one place they are all summoned to extinguish it. The latest fire-extinguishing apparatus is used by the rangers. On a tract of this size the damage by forest fires would be sufficient in the course of ten years to pay for the cost of the rangers.

A great number of other private forests are scattered throughout the country, including those owned by Mr. William C. Whitney, the Havermeyer estate, the Girard estate near Pottsville, Penn., that of Mr. H. C. Russell at East Greenwich, R. I., and of Mr. G. W. Vanderbilt at Biltmore, N. C. This last estate is of special interest to forest students and lovers because of the remarkable success obtained. The work was first organized at Biltmore in 1891 by Gifford Pinchot, now the forester of the Department of Agriculture, on about 4,000 acres of land. Additional tracts have since been added to the estate, until the whole extent of forest land brought under systematic treatment consists of over 100,000 acres. Dr. C. A. Schenck took up the work when Mr. Pinchot accepted the position as forester for the Department of Agriculture, and under his careful culture the forest has demonstrated many practical lessons to lumbermen and private owners of forests.

The forests of the Biltmore estate comprise to-day about 110,000 acres, 10,000 of which are located close to Asheville, with Mr. Vanderbilt's mansion in the midst. This home tract, as it is called, is made accessible by macadamized roads and dirt drives so that every acre of land can be worked by the foresters. According to Dr. Schenck's figures the $20,000 expended in building the roads through the woods have practically increased the value of the stumpage standing on the land by $40,000, owing to the accessibility of the trees for commercial purposes. Trees have no value so long as they stand out of the lumberman's reach, and forestry as a business enterprise must first bring them within the reach of a market. The annual output of this home tract of 10,000 acres is about 3,000 cords of wood, which finds a ready market at Asheville.

The large tract of 100,000 acres consists largely of virgin forest, and it has heretofore been entirely inaccessible for the lack of roads; the country, moreover, is so rough that railroad building is impossible. The tract lies in parts of four counties, bordering the head-waters of the French Broad River. In this immense forest the yellow poplar, or liriodendron tree, reaches an unusual size, and there are besides white oak, chestnut, hemlock, cherry, and other native forest trees. The work of building dirt roads, 16 feet wide, is now under way through this mountain tract to make the stumpage more accessible, the roads following as near as possible the main water courses. Several sawmills are located in the forest, cutting away the mature timber; after its removal, the young growth of yellow poplar, oak and chestnut springs up rapidly. This young growth is husbanded carefully and protected from fires—the greatest danger to forest culture in the South—at an expense of a few hundred dollars a year. Dr. Schenck estimates that for every mature tree removed the foresters give rise and life to about a thousand young seedlings.

Pisgah Forest is one of the roughest and wildest parts of the large mountain tract, and the task set in making the trees of commercial value is not merely that of the lumberman. It is an engineering problem as well, and requires large resources and much study to make it at all profitable. In the rich bottomlands made accessible by roads, the land will be cleared for farms, and it is the purpose of the owners to bring settlers there, who will furnish help as loggers and teamsters in the proper season and raise farm and food products for self support. Both agriculture and commercial forestry will thus be carried on at the same time. On the wind-swept mountain tops, where the tree growth of red oak and chestnut is stunted, there is found splendid pasture for cattle and sheep. These tracts have already been fenced in and considerable numbers of sheep and cattle are grazing there. The number of both is restricted, however, so as to prevent any permanent damage to the productiveness of the soil pastured. The idea of the forest management is to make every square foot of land pay permanently, and to bring up the investments in stumpage, roads, farms, buildings, and pasture fences to a figure which will prove remunerative.

There are many old abandoned farm tracts on the estate which have been planted with white pine. There have been planted already a great number of acres, and the work proceeds at the rate of 50 acres per year. About 4,000 white pines are planted to the acre at an expense of $12. These plantations will not be cut for fifty or sixty years. In 1960, Dr. Schenck says, this plantation should yield about 20,000 feet board measure of lumber, worth about $100, and yielding 3½ per cent interest on the capital invested. This is a long time to wait for returns on an investment, and it is this which deters the average farmer from taking up practical forestry as a living. Nevertheless, on a large estate where capital is plentiful, the returns are sure, the investment is gilt-edged.

Combined with the management of the forests of the Biltmore estate there is now a local forest school. This is not intended to be a college of forestry. It is rather a gathering of young men interested in forestry, and anxious to make forestry their life's profession. In the course of a few years the students get acquainted with the theoretical and practical side of forestry work. Every second year Dr. Schenck takes the students abroad to show them forestry methods as practised in European countries.

The Biltmore forests, and the management thereof, have been of special interest to the Forestry Bureau of the Department of Agriculture, both because of the excellent example set by the Biltmore estate for other owners of private woods, and because of the personal associations existing between the workmen in the two different fields. As the forester of the Department of Agriculture, Mr. Pinchot originally started the work on the Biltmore estate, and he has always felt a personal pride and interest in the growth of the enterprise under his successor, Dr. Schenck. Incidentally it may be said that many of the workmen and student assistants in the Forestry Bureau are sent down to the Biltmore estate at different times to make practical sudies of forestry as exemplified there. The Forestry Bureau is making plans to co-operate more and more with owners of private forests, both for the instruction of their student assistants and for the better preservation of the woodlands. The bureau is preparing working plans now for about 1,250,000 acres of forest lands owned by the different states, a good deal of which is in New York; and in addition to this there are applications for similar working plans for some 2,500,000 acres belonging to private owners. The Forest Bureau is thus rapidly expanding in its work, and the demand created for foresters who understand their work well enough to manage private forests exceeds the supply.

The torpedo destroyer "Viper" of the English navy, which ran on the rocks off the coast of Alderney, in the English Channel, in a fog during the recent English naval maneuvers, owing to its being abandoned, has been blown up by the Admiralty. Guncotton was utilized for this purpose, and the work was carried out thoroughly at high tide. The object of this course was to prevent the foreign fishermen who frequent this part of the Channel from obtaining any information regarding the secret mechanism of the destroyer. The court martial upon the officer who was in charge of the "Viper" at the time of the catastrophe has been held at Portsmouth. He attributes the disaster to the dense fog which was prevalent at the time, underestimation of the tides, which at this point at the time of the accident were running at five knots per hour, combined with the fact that he was keeping a sharp lookout to avoid one of the hostile cruisers which was in his vicinity. The court, considering the responsible nature of the work upon which the officer was engaged at the time, only reprimanded him.

THE TEMPORARY FOOTWAYS OF THE NEW EAST RIVER BRIDGE.

One feature of the new East River Bridge which illustrates the great labor and cost of erecting these long-span suspension bridges is the fact that the suspended structure, shown in position in the photographic views on the front page of this issue, is, all of it, temporary, and will have to be removed after the four great cables themselves have been completed. Of the two views, one is taken from the roof of a tall building to the south of the bridge on the Manhattan shore, and in taking the other photograph, the camera was placed at the center of the erecting platform on the summit of the Manhattan tower. From this point, 335 feet above the water, the view, as may well be imagined, is superb. Beyond the graceful sweep of the suspended footways, the view extends far to the eastward over Long Island, and northward up the Sound to New Rochelle and Larchmont, while to the south there is a magnificent panoramic view of New York Bay, Sandy Hook, and the New Jersey and Long Island shores.

The superstructure of the 1,600-foot main span of the bridge will be hung from four cables 18¾ inches in diameter. Each cable will be made of thirty-seven strands, and each strand will consist of 282 steel wires, 0.16 of an inch in diameter. Therefore, in each cable there will be 10,434 wires whose aggregate breaking strength will be 20,000 tons. The cables are being built by the John A. Roebling's Sons & Co., of New York, and the method of stringing and assembling the cables will be as follows: In the first place there will be four endless wire ropes extending across the bridge from anchorage to anchorage, which will be capable of being moved in either direction by steam power. There will be one of these ropes in the plane of each cable, and each will pass around sheaves at the anchorages and will serve to carry a bight of the cable wire across the river. The wire will be carried to and fro from anchorage to anchorage, passing each time around shoes which will be made fast at a point several feet back from the anchor pins. When the end of the one coil of wire is reached it will be spliced to the end of the next coil, and the strand of 282 wires will be made continuous throughout. During the process of making, the strand will hang from 12 to 16 feet higher than its final position in the finished main cable; and as soon as it is completed, it will be slacked away at the anchorages until it has been lowered and included among the thirty-seven strands that form the cable.

To accommodate the numerous workmen who will be scattered throughout the whole length of the cables, and who will have to see that the wires are laid parallel under an even tension, and properly lashed together into strands, a working platform, or foot-bridge, has been built from anchorages to top of towers and across the main span of 1,600 feet. The foot-bridge affords a working platform, placed in the vertical plane of each cable for its full length, and it is so arranged that two strands of each cable, or eight in all, can be made at one and the same time. In the middle span, the foot-bridge consists of two parallel, double-decked bridges, which are about 70 feet apart and are connected by transverse truss bridges which are 160 feet apart. These connecting bridges are very clearly seen in the view of the bridge taken from the top of the tower. Each of the footways is carried on two temporary cables, each of which is made up of three 2¼-inch steel-wire ropes. The upper deck of the foot-bridge will be used for the construction of the strands and the lower deck for the assembling of the strands in the finished cable. The platforms are 3½ feet wide between the centers of the handrails, and they are made continuous throughout the whole 1,600 feet of the main span.

In order to stiffen the main span and prevent violent swaying and distortion in strong winds, there are four 2¼-inch storm cables, which are attached to the towers and curve upward to meet the underside of the foot-bridge at the center of the span. There is also a series of ¾-inch guide-ropes, extending diagonally from the point of connection of the storm cables to the tower, to a connection with the bottom floor of the foot-bridge. The storm cable is also tied at regular intervals to the foot-bridge by vertical ⅝-inch suspenders. At the top of each tower there is a large working platform measuring 36 feet x 107 feet. Over each pair of saddles is a heavy wooden frame with a hydraulic lifting gear to raise the strands, as they are completed, from their temporary saddles, and transfer them to the main saddles. When the whole thirty-seven strands of a cable have been thus assembled, they will be bound with a special pattern of steel clamp at intervals of every 20 feet, the clamps having formed in them saddles to receive the suspenders by which the floor of the bridge is carried. Half-round, steel covering plates, or shields, will then be clamped over the cables to protect them from the weather.

Science Notes.

The Alfred millennary will be celebrated at Winchester, England, September 20, and the statue of King Alfred, by Thorneycroft, will be unveiled.

A new product prepared from the cocoanut, and known as "vegetaline," is being manufactured by a Marseilles firm. The product is a kind of butter, and is stated to be particularly adapted for bakers and confectioners. It is much cheaper than butter, and is stated to be better adapted for pastry, and more especially biscuits. It consists of refining the oil extract from the dried cocoanut. It is perfectly pure and nourishing. It only resembles butter in its fatty nature, but it is pure white and much harder than the dairy product.

The seventy-five Eskimo dogs which are to accompany the British Antarctic expedition are being dispatched to Melbourne by a fast liner, and at that port will be transferred to the "Discovery." The problem of safely conveying the animals through the tropics presented many difficulties, but it has finally been solved by housing the animals in the refrigerating chamber while crossing the equator. By this means they will be maintained in an atmosphere, the temperature of which will be similar with that of Greenland, whence they were brought.

Mr. J. G. Rhodin, of Manchester, England, has discovered an economical method of manufacturing potassium salts from feldspar. The feldspar is primarily finely ground, and is then mixed with slaked lime and sodium chloride, the mixture being subsequently heated to 900 deg. C. By this means about 85 per cent of the potassium in the feldspar is extracted in the form of potassium chloride. It is stated that the process is very cheap and is well adapted for commercial purposes. It is proposed to carry out a series of further experiments with the process prior to erecting a factory in Sweden for the manufacture of potassium salts upon an extensive scale. The latter country is peculiarly adapted as the center of such an industry owing to the abundance of feldspar which is to be found there, and for which so far there has been no commercial utility. Another prominent feature of the process is that the insoluble residue that remains after the potassium and sodium salts have been extracted by water constitutes an excellent material for glass manufacture by the addition of a little sand and alkali.

German papers speak of an annual plant growing in tropical Africa, belonging to the leguminous class, which is largely cultivated by the negroes as a food article. It has also been introduced to some extent in Southern Asia and in Brazil. It is called woandsu by the African negroes; the botanical name is *Glycine subterranea*. A French expert chemist of aliments has recently analyzed the fruit of the woandsu with reference to its chemical composition and its value as food. The fruit, like the peanut, matures under ground. The eatable kernel has the shape of an egg and is dark red, with black stripes and a white hilum, like most beans. It furnishes a very white flour, whose flavor after cooking much resembles that of chestnuts. The chemical composition is 58 per cent of starchy substance, 19 per cent nitrogenous, 10 per cent water, 6 per cent oily, 4 per cent cellulose substance, and 3 per cent ashes. It will be seen that two pounds of these beans would supply the daily requirements of the human system. M. Balland, who has had wide experience in the chemistry of nutriments, calls this fruit the first one found by him in a natural state which shows all the chemical properties of a perfect nutriment.

The British Association will meet this year at the Glasgow Exhibition under the presidency of Prof. Rücker, who was recently appointed principal of the reorganized London University. He is the leading expert on magnetism in Great Britain, and his address will include references to the voyage of the Antarctic exploration ship "Discovery," and its searches for the South Magnetic Pole. The zoological section will be under the presidency of Prof. Ewart, the great authority upon hybrids, and the results of his experiments, together with those of Lord Edward Cecil, will provide interesting material. The physical science section will be presided over by Major Macmahon, whose reputation is based upon abstruse mathematics purely. Prof. John Milne will read a paper devoted to his seismological instruments, and his observances of earthquakes. Mr. Horne, the chief of Scotland's survey, takes the chair of the geological section. He is the most prominent savant on cataclysms, eruptions, submergences, etc. The geographical chair, owing to the dearth of travelers, will be presided over by Dr. H. R. Mill, the well-known rainfall expert. The engineering department will be under Col. Compton, and the main discussions will be devoted to automobile transit and the Panama Canal. Prof. Cunningham will take the anthropology section, and educational science, the new ramification which the British Association have recently taken up, will be undertaken by Sir John Gorst.

Engineering Notes.

The new Italian submarine vessel "Delfino" has proved very satisfactory. It is provided with an instrument which permits a submarine vessel navigating below the surface to have a view of the whole horizon while it is under water. It is called a cleptoscope, and was invented by two Italian engineers.

The manufacture of chilled wheels is now in full operation at Barrow in Furness, by the British Griffin Chilled Iron and Steel Company. This firm is attempting to introduce the American method of manufacture into England, but there is no demand upon the English market at present. These new works, which were only started two or three months ago, are making a determined attempt, however, to prove the value of this system of manufacture, and already have supplied thousands of wheels for tramways both in England and her Colonies.

Sir Raylton Dixon & Co., of Middlesbrough, Yorkshire, have completed the construction of the repair ship "Assistance" for the British Admiralty. This vessel is a new type of war craft, and in reality consists of a floating workshop, for the undertaking of those repairs to battleships while at sea which do not necessitate a visit to the drydock. The "Assistance" is 436 feet in length by 53 feet beam, and has a displacement of 9,600 tons. Her engines are of 4,200 horse power, and she has a speed of 13 knots per hour. She is to be attached to the Mediterranean fleet.

The total number of vessels lost during the last quarter in 1900 was 224, representing a tonnage of 171,996. Of this number 126 were wrecked, 15 are missing, 8 foundered, 13 went down in collisions, and 10 were burned, 28 were broken up, condemned, etc. Out of the total tonnage lost, 61,715 tons were vessels belonging to the United Kingdom of Great Britain. Norway is second, with 24,704 tons; followed by Italy with 21,287 tons. The United States is fourth on the list, with 13,617 tons. The losses of the other countries do not exceed 10,000 tons. The proportion of loss sustained by the Italian merchant service is much higher than that of any other country mentioned.

The British House of Commons has finally sanctioned the Behr Monorail between Liverpool and Manchester. As the bill has already met the approval of the House of Lords, it is anticipated by the promoters that the scheme as permitted by the Lower House will be ratified by the Lords. It is intended to commence work upon the railroad early next year. The contract will occupy about three years. Electricity will be the motive power employed, and as the road will be constructed with easy gradients it is proposed to maintain a high speed with perfect safety. The journey of 35 miles between Liverpool and Manchester will be covered within 20 minutes without any intermediate stoppages. The brake arrangements which the Parliamentary committee previously contended to be inadequate are now such that it will be possible to pull the train up within 500 yards while traveling at 110 miles per hour.

A fast line of steamers is contemplated to ply between New York and Berehaven, in the southwest of Ireland. This is the nearest British port to this country, and the journey between the two points would be accomplished in four and a half days. Passengers disembarking at Berehaven will be dispatched across Ireland by rail to Dublin, and thence by steamer to Liverpool. The establishment of this service will thus considerably curtail the journey between the two countries and will probably prove of great commercial value. Berehaven possesses a magnificent natural harbor, so that the erection of the necessary wharves and docking accommodation can be carried out expeditiously. A bill, authorizing the construction of piers and other harbor works, is now being passed through the English Parliament. The realization of this scheme, which has been contemplated for years past, has hitherto been opposed by the Admiralty, since extensive naval works are being undertaken at this port. When the harbor works have been authorized the erection of the steamers for the traffic will be proceeded with. The vessels will be built in England.

One of the most practical laws passed this year by the New York State Legislature was the Elsberg Fire Drill Law, which makes it the duty of every person in charge of an educational institution within the state, having more than 100 pupils, to instruct and train the pupils by means of drills, so that in a sudden emergency they may be able to leave the school building in the shortest possible time without confusion or panic, says Insurance Engineering. Such drills shall be held at least once in each month. Neglect by any principal or other person in charge of any such public or private school to comply with the provisions of the act shall be a misdemeanor, punishable at the discretion of the court by a fine not exceeding $50. The provisions of the act do not apply to colleges or universities. The value of such fire drill has been repeatedly demonstrated in isolated cases, and it is to be hoped that the provisions of Senator Elsberg's bill will be very generally enforced,

Automobile News.

It is reported from Paris that Major Krebs has invented and will shortly bring out an extra light motor weighing hardly 10 pounds, intended specially for aerial navigation.

An interesting excursion across the Alps has lately been made by a party of chauffeurs in a 12 horse power machine—Messrs. Leuchantin, Director of the Pignerol Tramways; Agnelli, Secretary of the Turin Automobile Club, and Storero. Starting from Turin at 7 o'clock A. M., they passed by Pignerol, Fenestrelle and Sestrière, crossed Mount Ginevro and arrived at Briançon (France) at 11 o'clock. Here they halted for dinner, and then left Briançon at 3 o'clock in the afternoon and following the Sesana-Oulx-Suse route, returned to Turin at 6:15 P. M. The total length of the route is over 180 miles, and it has many grades which gave a severe test to the machines. The time required to make the trip (not counting the halt) was 7 hours and 15 minutes.

The British War Office, for the purpose of ascertaining the efficiency of motor cars for military transport purposes, propose making a number of exacting trials with self-propelled vehicles through the southeastern counties. The routes have been prepared by Captain Lloyd, R.E., secretary to the War Office Committee on Mechanical Transport, and the roads that have been selected include some of the steepest gradients to be found in the country, while their conditions are so varied in character that an adequate comprehension of the utility of motor cars for transport will be obtained. It is expected that no lorry when fully loaded with fuel, water, and carried load, will exceed 7 tons in weight. This weight will probably be borne on four wheels, and the driving wheels will have to sustain the major portion of the load—approximately 5 tons. The tires of the driving wheels must measure at least 9 inches in width. The trailers, which may possibly be two-wheeled vehicles, will not weigh, when fully loaded, more than 3½ tons. About thirty vehicles will participate in these elaborate trials, and they will follow in procession with large intervals between each competitor.

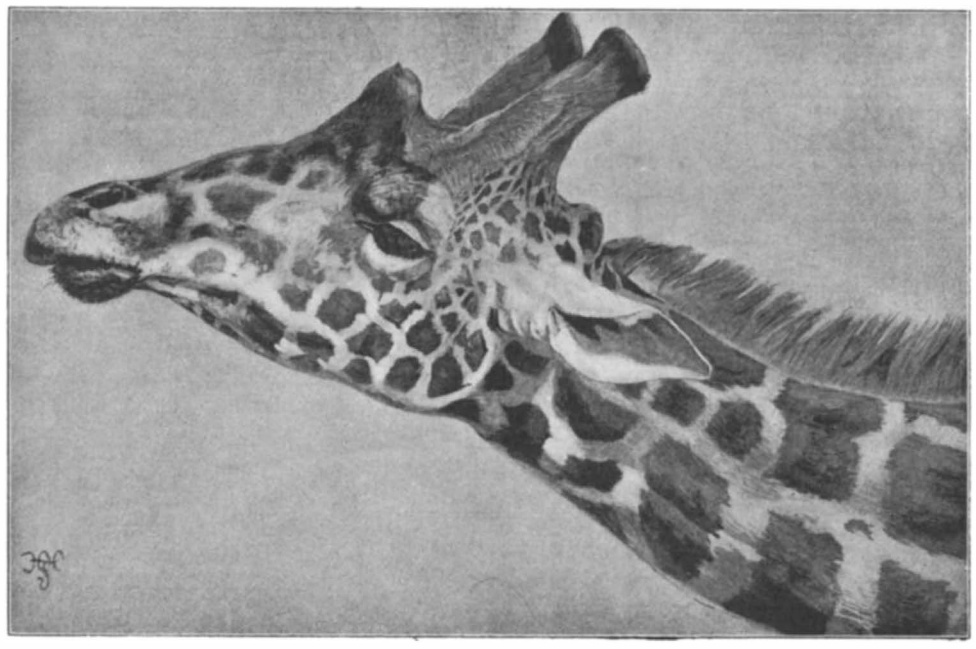
The hill-climbing race at Laffrey, organized by the Dauphinois Automobile Club, took place on the 11th of August, and was a great success. The Laffrey grade is well known in France, and is considered a good test for the machines. The route starts from Vizille, at 863 feet altitude, and passes through Laffrey, which is at 2,867 feet altitude. The part laid out for the race includes the first 20,040 feet, and the grades vary from 7 to 13 per cent, with an average of 9.3 per cent. There were 31 machines entered, of which 23 started and 19 were able to finish. The starts were made from Vizille every 2 minutes, beginning at 7:30 A. M. The race was divided into two sections, speed and touring. In the former the results are as follows: Voiturettes up to 880 pounds, 2 persons. Winner, Maudiguet, on a George Richard 8 horse power machine, in 23 min. 10 sec. Light machines, 880-1,430 pounds, 2 persons. Winner, Rigoullot, with a Peugeot 8 horse power machine, in 22 min. 7 1-5 sec. In the heavy machine class Kraeutler made the best time of the race in 16 min. 2 3-5 sec. Among the tourists Boissy was the winner in the light vehicle class for 4 persons (Peugeot 8 horse power), in 26 min. 2 sec. In the heavy machine class, 4 persons, the best time was made by Ribes, in 26 min. 37 sec. The race afforded a good proof of the power and good working of the machines, and besides the above-named makes the Rochet, Darracq, Cottereau, Panhard, and Delehaye showed a good performance.

A public automobile service has been lately inaugurated between two towns in the neighborhood of Vienna, Payerbach and Reichenau. The electric system is used, and the vehicles are of the large omnibus pattern, very comfortably arranged, and make good time. They are built by Jacob Lohner & Company. The system is said to have already met with great favor by the inhabitants, and especially by the foreigners who pass the summer at Richenau, which is a watering-place of some importance. In England the night service for the distribution of freight from London to Tunbridge Wells, a distance of 35 miles, was commenced a short time ago, and is now in successful operation. Another automobile passenger and baggage system is that which has been inaugurated in Corsica, between Bastia and the Cape. An omnibus starts every day from Morsiglia to Bastia at 6 A. M. and at Bastia at 2 P. M. for the return trip. Each passenger is allowed 22 pounds of baggage, and pays 2 cents per pound for extra amount, but the total is limited to 66 pounds. Several automobile passenger systems are in project for connecting the coast towns of Tunisia. That from Sfax to Soussa (85 miles) has made the greatest progress, and the first vehicle, called "La Sfaxienne," made its trial trip on July 30. The system is controlled by the Société d'Etudes des Messageries Automobiles. A series of trials will be made to determine the best conditions of running. It is proposed to have two classes; at present there is but one class, and $3 is charged for the trip.

THE FIVE-HORNED GIRAFFE.

Sir Harry Johnston's discoveries in Uganda are of great importance. One of the new animals which he found was the "Okapi." It has no near living relation unless it be the giraffe, and belongs to a group of ruminants only represented at the present time by the giraffe and the prong-horned antelope, so-called, of North America. So far as can be ascertained the okapi is a living representative of the Hellatotherium genus, which is represented by extinct forms found fossilized in Greece and Asia Minor. The Hellatotherium may be described as a poor relation of the giraffe which has lost all but minute traces of its former horn cores, for the giraffe, it will be remembered, has on its skull three bony prominences from which horns or antlers sprang. The animal is about the size of a large ox. The coloration is, perhaps, unique among mammals. The body is of a reddish color, the hair is short, and the appearance of the hide is extremely glossy. The legs are cream color, but the skin between the stripes is often white; the legs and hind quarters only of the animal appear to be striped.

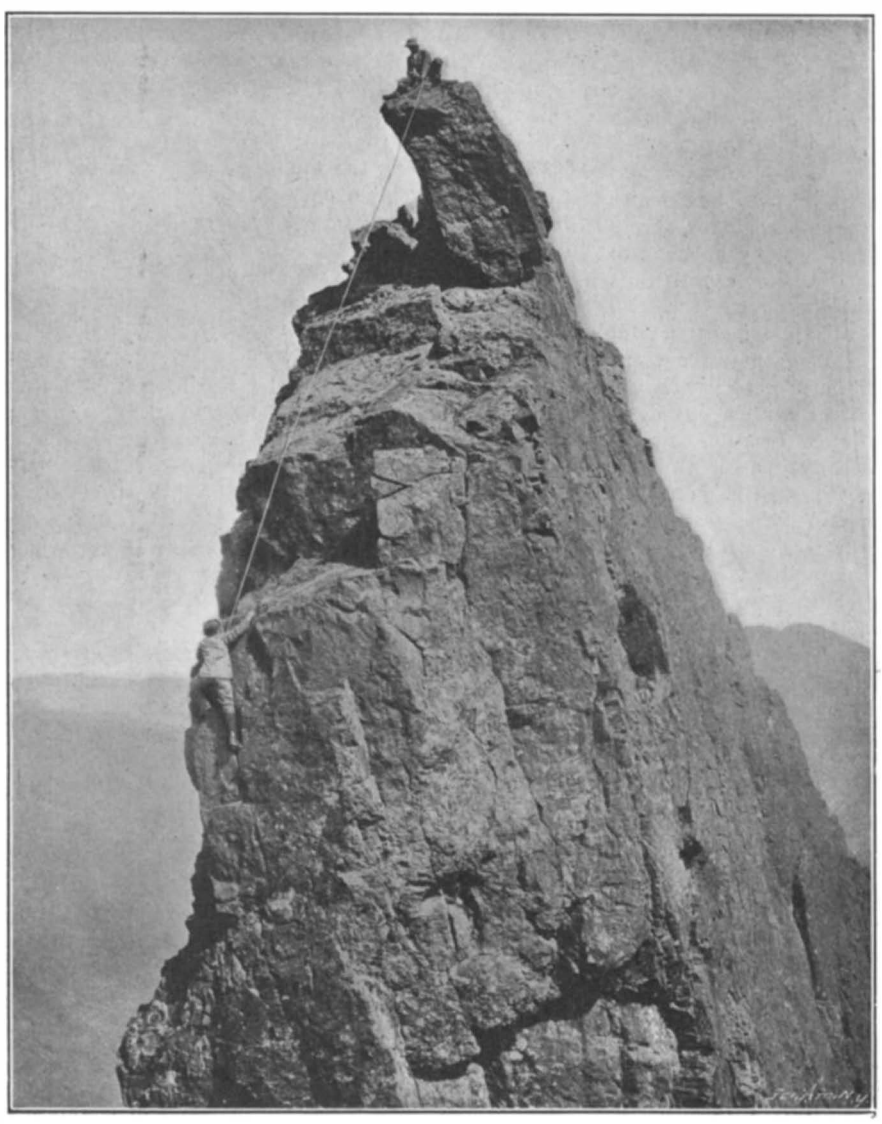
Another animal which Sir Harry Johnston has found in Uganda is a five-horned giraffe, and our illustration is made from the drawing by Sir Harry Johnston and reproduced from The London Graphic, to which we are indebted for our particulars. The specimens of the five-horned giraffe were shot in the country lying to the east of Mt. Elson in the north-eastern part of the Uganda Protectorate. The females had only three horns, while both the male specimens exhibit five-horned cores.



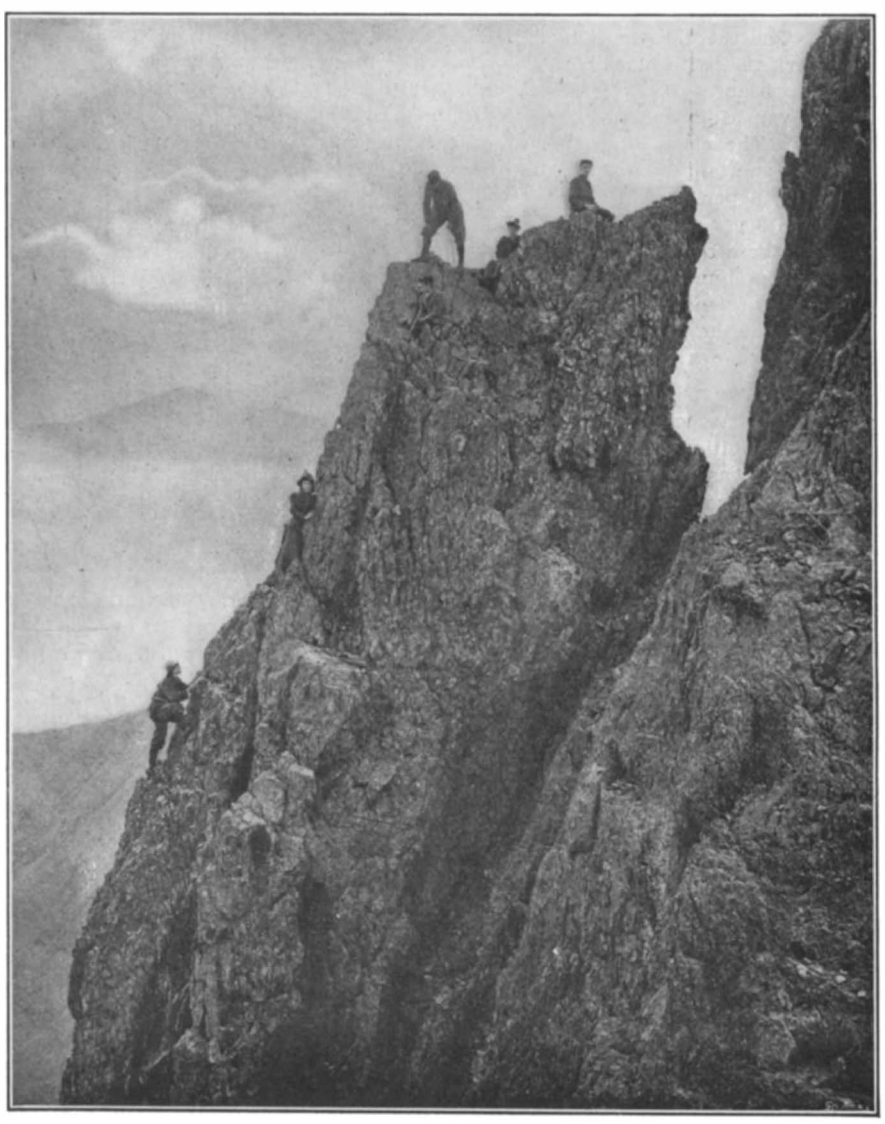
HEAD OF NEW FIVE-HORNED GIRAFFE DISCOVERED IN UGANDA BY SIR HARRY JOHNSTON.

THE ASCENT OF THE MATTERHORN.

The Matterhorn is one of the most difficult mountains in the world to climb, and only this year the beautiful and severe-shaped peak has claimed its victim. This grand mountain, though not the loftiest of its district, is the most beautiful and fascinating. It is exceeded in elevation by Monte Rosa, the two highest points of the Mischabelhörner, the Lyskamm and the Weisshorn. Attempts to ascend the Matterhorn were first made in 1858 and 1859; other attempts were made in 1860 and 1861, the most notable of which was that made by Edward Whymper, an English mountaineer, in the latter year. Other attempts were made, and finally on the 13th of July, 1865, Mr. Whymper's party started from Zermatt to make what proved to be at once a most successful and a most fatal ascent. There were eight in the party, the guides Croz, Peter Taugwalder, and his two sons, Lord Francis Douglas, Mr. Hadow, the Rev. Charles Hudson and Mr. Whymper. The start was made at 5:30, and before 12 o'clock they found a good position for their tent at a height of 11,000 feet. Here the happy party remained for the night, and the start was made before dawn the next morning. For the greater part of the rest of the way there was really no occasion for the mountaineers and guides to be roped together. Climbing then became difficult, the interstices of the steep rock face having only occasional fragments projecting here and there. These were at times covered with a thin film of ice produced from the melting and refreezing of the snow. An hour and a half was occupied in ascending this difficult section. The party finally reached a spot where only 200 feet of snow remained to be surmounted, and at 1:40 P. M. the Matterhorn was conquered. A stone cairn was built, and after an hour had been spent on the summit the party commenced the descent. They were tied together with great care, and only one man moved at a time. When he was firmly planted the next advanced, and so on. A few minutes later a sharp-eyed lad ran into the Monte Rosa Hotel at Zermatt, saying that he had seen an avalanche fall from the summit of the Matterhorn. What happened was that on the descent the guide Croz had laid aside his axe in order to give Mr. Hadow greater security, and taking hold of his legs was putting his feet, one by one, in their proper position; all were roped together and no one was actually descending. Croz was in the act of turning around to go a step or two himself, when at this moment Mr. Hadow slipped, fell against Croz and knocked him over. Mr. Whymper heard some startled exclamation from Croz and saw him and Hadow flying downward. In another moment Mr. Hudson was dragged from his steps, and Lord Francis Douglas instantly followed him. Immediately after hearing Croz's exclamation Taugwalder and Mr. Whymper planted themselves as firmly as the rocks would permit. The rope was taut between them, and the drag came on both as on one man. They held on and the rope broke midway between Taugwalder and Lord Francis Douglas. For a few moments they saw their unfortunate companions sliding downward on their backs and spreading out their hands, endeavoring to save themselves. They passed from the sight of the survivors, disappearing one by one, falling from precipice to precipice on to the Matterhorn Gletscher below, a distance of nearly 4,000 feet. From the moment the rope broke it was impossible to help them. For the space of half an hour the survivors remained on the spot without moving a single step. Finally the old guide summoned up courage and changed his position to a rock on which he could fix the rope. Mr. Whymper examined the broken rope and found to his horror that it was the weakest of the three which had been broken. It was intended as a reserve, to be left attached to the rocks. For two hours afterward Mr. Whymper thought that every moment would be his last, for the Taugwalders were utterly unnerved and were not only incapable of giving assistance, but were in such a state that a slip might have been expected from them at any moment. About 6 P. M. they arrived at the snow upon the descent toward Zermatt and all peril was over. The descent was again begun, and at 9:30 a resting-place was found upon a slab barely large enough to hold the three, where they passed six miserable hours. At daybreak the descent was resumed and Zermatt was finally reached. A party of twenty men were sent out to find the bodies of the unfortunate men. All but the body of Lord Francis Douglas were discovered; of him nothing could be found. It was at first thought wise to allow the bodies to remain buried in the snow



AN ARRETÉ ON THE MATTERHORN.

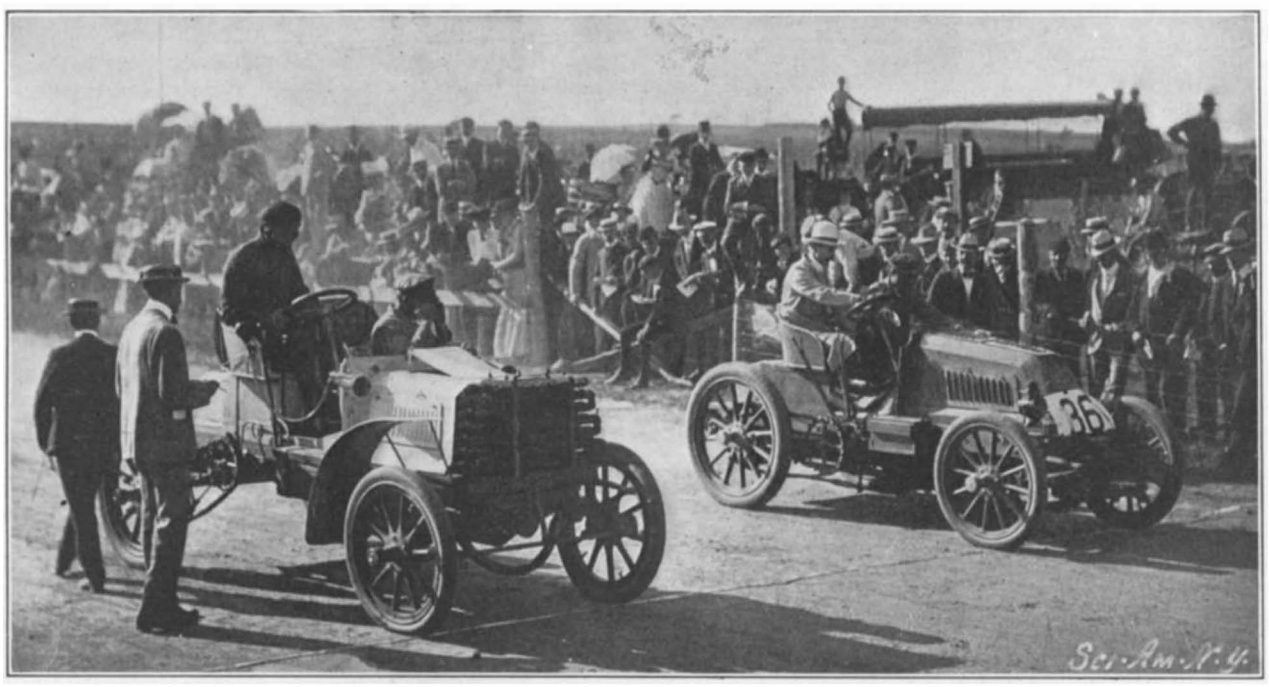


"CRAGGY PINNACLE," A DIFFICULT PIECE OF ROCKWORK IN WALES.

at the base of the grandest cliff of the most majestic mountain of the Alps, but the authorities sent strict injunctions to recover the bodies, and on the 19th of July twenty-one men of Zermatt accomplished this sad and dangerous task. The remains of Hudson, Hadow, and Croz were interred in the little churchyard in Zermatt. So the inaccessibility of the Matterhorn was vanquished, and Mr. Whymper well says that it proved to be a stubborn foe. It resisted long and gave many a blow; it was defeated at last with an ease that none could have anticipated, but like a relentless enemy—conquered, but not crushed—it took terrible vengeance. Thirteen lives in all have been lost on the Matterhorn. In July of this year a party of five tourists, including two ladies and two guides, started to climb the Matterhorn. One of the ladies turned to look at the view, slipped and fell with two companions; the guide held them for a moment, then all three were precipitated a thousand feet. Strange to say, one lady and the guide survived, although the latter was insane when found by the party sent to rescue them.

The various Alpine clubs and guides have minimized the danger by building huts and shelters, and by placing hand supports and ladders in many of the most difficult places. Still, it is a very formidable task to ascend to the summit of the Matterhorn, as will be seen by one of our engravings, which shows a most difficult piece of rock work where the least slip would cause a fall of many thousand feet. Difficult rock work is not confined to either the Matterhorn or Switzerland, as will be seen by our second engraving, which shows mountaineering in Wales where the situation seems fully as alarming.

Start of Motor Bicycles, Tricycles and Electric Vehicles.



Mr. D. W. Bishop with His Panhard Racer and Mr. Foxhall Keene with His Mors Machine.

THE NEWPORT AUTOMOBILE RACES.

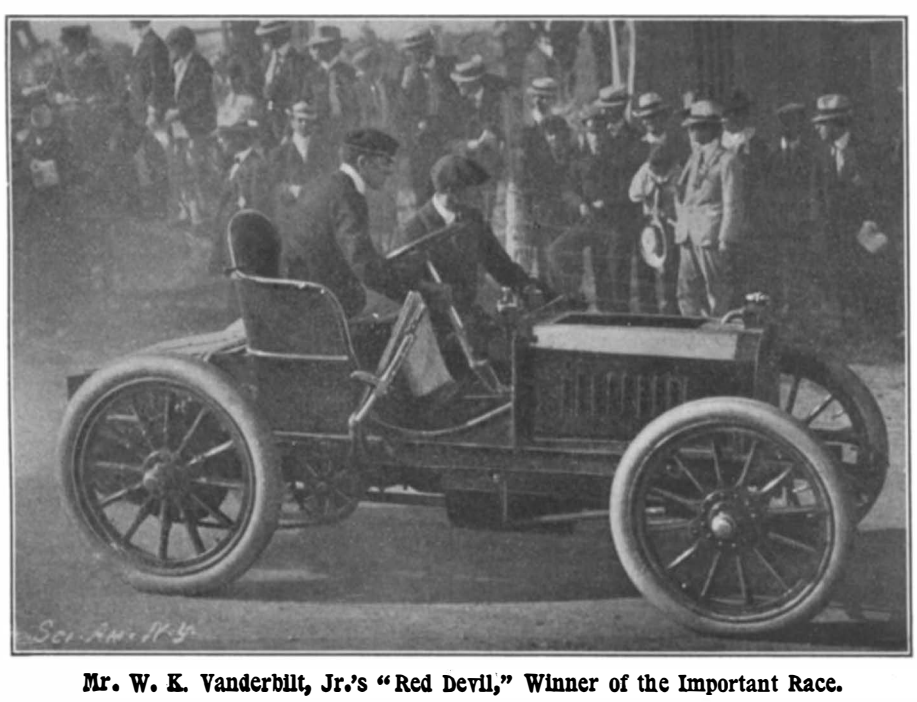
It was at first proposed to hold the automobile races of the National Automobile Association on the famous Ocean Drive, at Newport. Permission was obtained to practically close the Drive during the races, but some of the residents along the route applied to the Supreme Court and obtained an injunction prohibiting the use of the public roadway for the speed contests. As a result the races took place at Aquidneck Park, which was not a desirable place for holding the meeting owing to the fact that the track is only a half mile in length and the curves were not well adapted to attaining high speeds, especially for the high-power machines. There were sixteen heats to decide the six races. The first division was for tricycles, two-wheeled vehicles and electric carriages. One of our engravings gives a view of the start in this event. The course was three miles, for a first prize offered by Mrs. John R. Drexel, and the second prize offered by Mr. W. K. Vanderbilt, Jr., and a prize for the electric carriages was offered by Mr. Alfred Vanderbilt. The race was won in 5.40 minutes by Mr. Kenneth Skinner, who rode the tricycle seen at the left of the first group. This was one of the most exciting events of the afternoon as the speed attained by both the bicycle and tricycle was great. The bicycle led for about one-half the distance but was finally passed by the tricycle.

The second division was composed of steam-propelled vehicles and the race was run in two heats and a final for a first prize offered by Colonel John Jacob Astor; the distance was 3 miles. The first heat was won by Mr. J. McMillan Hamilton, in 6.25½. The second heat was won by Mr. John Powers, time 6.20. The final heat of 5 miles was won by Mr. John Howard, the best time being 11.41.

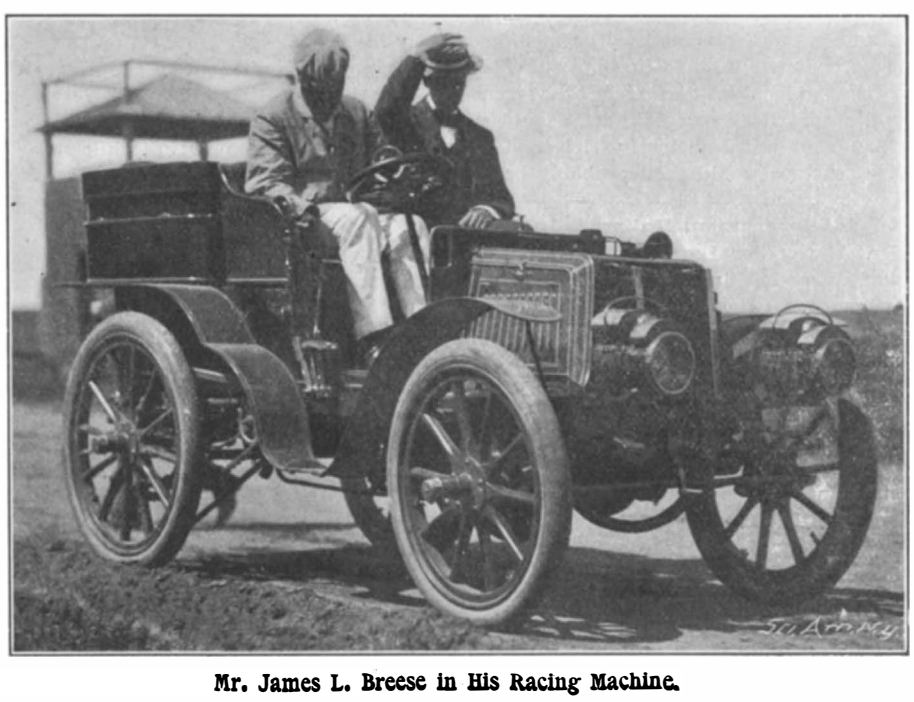
The third division was a special class of DeDion 5 horse power voiturettes, and the race was won in one heat of 3 miles by Mr. O. H. P. Belmont, his time being 7.33¼.

The fourth division was for gasoline vehicles not developing more than 12 horse power and was run in six heats and a final for a first prize offered by Mrs. Herman Oelrichs, and a second prize offered by the National Automobile Racing Association. The first heat of 3 miles was won by Mr. F. Walsh, time 6.06¼. Mr. Alexander Fisher came in first in the second heat, time 6.45; the third heat of 3 miles was won by default by Mr. C. G. Dinsmore. The time was not taken. The fourth heat of 3 miles was won by Mr. C. Macy, the best time being 6.17½. The fifth heat was won by Mr. Kenneth Skinner by default; no time was taken. The sixth heat went to Mr. Alexander Fisher, time 9.46. The final heat of 5 miles was won by Alexander Fisher; the best time was 9.37½.

The fifth division was for gasoline vehicles developing over 12 horse power, the race being in two heats and a final for a first prize offered by Mr. W. K. Vanderbilt, Jr., and a second prize offered by Mr. Joseph Widener. This was the greatest event of the meet and very exciting heats were run. The first was between Mr. Foxhall Keene and Mr. David W. Bishop,



Mr. W. K. Vanderbilt, Jr.'s "Red Devil," Winner of the Important Race.



Mr. James L. Breese in His Racing Machine.

THE NEWPORT AUTOMOBILE RACES.

Mr. Keene driving his 60 horse power Mors car and Mr. Bishop his Panhard racer. Mr. Keene obtained a better start and at the end of the half-mile was 75 yards ahead and he continually increased his lead so that by the time he had covered 3⅞ miles he had lapped his opponent and won the race by over half a mile. In the second heat, which was also 5 miles, the contestants were Mr. W. K. Vanderbilt, Jr., who drove his "Red Devil," a Cannstadt-Daimler vehicle of 35 horse power, and his opponent was Mr. Wm. N. Murray, of Pittsburg, who drove a Winton racer of 40 horse power. It must be said for the credit of the American machine that while the "Red Devil" obtained the lead at the start, the Winton machine being slow in getting under way, but finally gained upon his opponent and it was not until 2½ miles had been covered that the "Red Devil" began to pull away. Mr. Vanderbilt won, making the 5 miles in 7.43½, while his opponent was only 44 4-5 seconds behind him. The final heat of 5 miles was run by Messrs. Vanderbilt and Keene. A terrific speed was developed by the "Red Devil," and at the end of the 5 miles Mr. Vanderbilt was an eighth of a mile in the lead, and from that time on he slowly gained until the finish, when he was a winner by 10 3-5 seconds, the time being 7.36¾.

The sixth and last race was the championship for winners in all classes in one heat of 10 miles, for prizes offered by Mrs. O. H. P. Belmont and the Locomobile Company of America. It was won by Mr. W. K. Vanderbilt, Jr.; the best time was 15.23½. The day was an ideal one for a race and the results attained were considered very satisfactory.

Submarine Oil Beds.

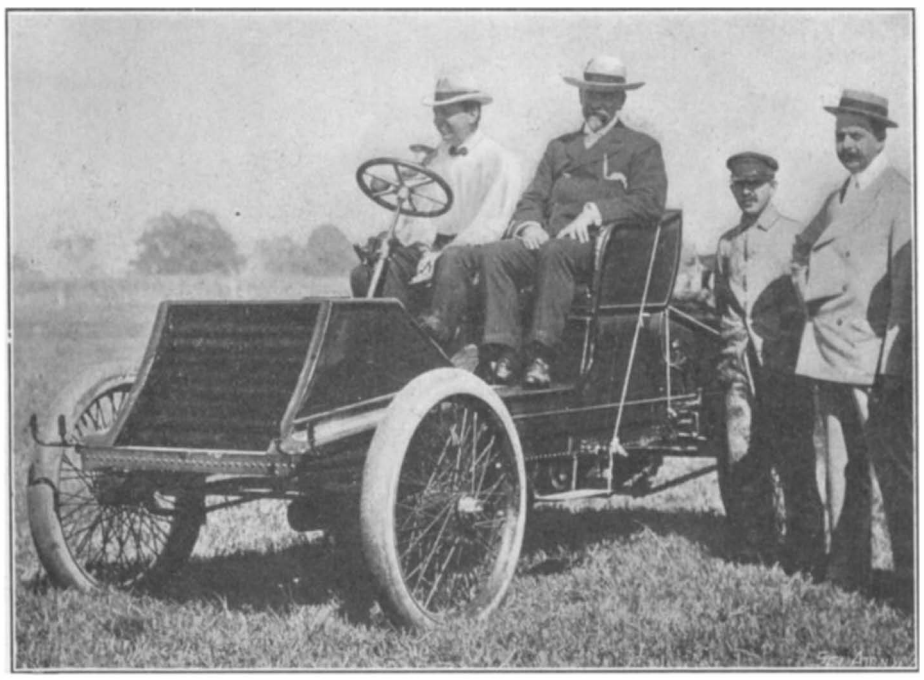
For some time past the Russian authorities have been exploring the petroleum producing country round Baku, and the result of these investigations has substantiated the hypothesis of experts that these naphtha beds are not only to be found at Baku, but that they extend for some distance beneath the sea. An attempt to utilize these submarine resources is seriously contemplated, especially on the coasts of Bibi-Eibat and the island of Swjitoi. The depth of water at the former place ranges from 14 to 50 feet, and at the latter to about 39 feet. The most serious problem that confronts the government is how to tap these submarine deposits without endangering the land supplies and public property and life. The plant, such as reservoirs, pumping stations and power stations, must necessarily be similar to those employed on shore. The difficulty of transporting the naphtha is very complex. Small boats could not be employed owing to the large quantities of sand which the fountains invariably throw up, while the utilization of steam vessels in a naphtha-laden atmosphere would be fraught with considerable danger. The only means of solving the problem is by enclosing the area with a sea wall, but as such a reclamation scheme could be only undertaken at tremendous expense. and as the value of the oil beneath is purely supposititious, both in quantity and quality, the completion of such elaborate works might prove unremunerative. As a tentative effort to discover the value of these submarine deposits, the government suggests that Romany Lake, one of the centers of Baku, should be laid dry and the soil tested. Several petroleum firms have made offers for this concession, but as none of them has been deemed sufficiently high, the government intends to empty the lake at its own expense and to let the area thus recovered, in the usual way. If the experiment should prove successful and the oil sufficiently rich and abundant, the other schemes would then probably be undertaken.

Government Railways in Europe.

Dr. A. von der Leyen, a railroad expert, has published an article in the June number of the German Review, says Science, concerning the management of the government railroads of Prussia, of which Consul-General Günther sends an abstract to the Department of State.

He demonstrates that the example of Prussia in buying the private railroads and running them on government account has contributed to popularize this system in other countries, and states that not only have the other German states followed it, but that almost all other European countries have purchased the existing railroads.

The Austrian government railroad net has to-day a mileage of almost 6,300 miles; that of Hungary, about 8,150 miles. Since 1882 a great change has taken place in Russia; of the then existing 14,000 miles of railroad, only about 40 miles were owned by the government. The total mileage in 1897 was about 24,300 miles, of which 15,780 miles belonged to the government. To this must be added the government railroads in Finland and Asiatic Russia, the Trans-Caspian and the Siberian railroads. The Servian, Roumanian and Bulgarian railroads are owned exclusively by the respective governments. Of the northern European kingdoms, Denmark has a government railroad system of 1,167 miles and 525 miles of private railroads. Norway's railroads belong almost exclusively to the government. Sweden has 2,303 miles of government and 4,387 miles of private railroads. The government has not yet succeeded in acquiring the latter, although efforts have been made to do so. Belgium, in 1898, through the purchase of the Grand Central Belge and some minor private roads, became the possessor of the whole Belgium railroad system. Holland acquired all the remaining private railroads in 1890; they are, however, operated by two private companies. The Italian government purchased all private main railroads of Italy in 1885 and leased them for twenty years to private corporations. Mr. von der Leyen states that both the last countries have had unpleasant experiences with this arrangement. Switzerland, after long discussion, resolved by federal law in October, 1897, to gradually purchase all the private railroads. On January 1, 1901, the first federal railroads were operated by the government. By agreements of 1883, the six large French private railroads had their rights recognized by the government, and no change has been made in the policy in that country. The relatively small government railroad system, located between the Orleans and the Western railroads, has remained intact. As the private railroads, however, have received large subsidies from the government, and as they will revert to the state in the second half of the present century, they can hardly be considered purely private railroads. Of the countries which have a private railroad system exclusively, only England and the United States remain.



Mr. Murray with His Forty Horse Power Winton Racing Machine.

Preservation of an Historical Locomotive.

The famous engine "General," which was used by Capt. James J. Andrews and his party of raiders in an attempt to burn the bridges on the Western and Atlantic Railway on April 12, 1862, has been sent by the Nashville, Chattanooga & St. Louis Railroad to be set up in the Union Depot at Chattanooga as a monument to the heroes of that daring raid, says The Railway Review. It will be remembered that the engine and several box cars were stolen from a passenger train while the crew was at breakfast at Big Shanty. The raiders were closely pursued by the conductor and a party of Confederate soldiers in the switching engine. The "General" was finally abandoned and the bridge-burning scheme had to be given up. All of the party, numbering some twenty-two, were captured and eight were executed as spies. The survivors built a monument in memory of the affair in the National Cemetery at Chattanooga.

When the two Hungarian scientists, Messrs. Pollak and Virag, displayed their new telegraphic apparatus at the Paris Exhibition last year, they were invited by the French government to make experiments with it over the lines between Paris and Lyons. On account of the enormous expense, however, the inventors declined the invitation. Since that time, however, they have established a line of their own extending from Buda-Pesth to Fiume, a distance of 375 miles, and have been carrving out a series of tests with their apparatus. A speed of 40,000 words per hour has been attained.

How to Construct an Efficient Wireless Telegraph Apparatus at a Small Cost.

By A. Frederick Collins.

Since the practical introduction of wireless telegraphy in 1896, great progress has been made, not only in spanning great distances, but in syntonizing or tuning a certain receiver to respond to a given transmitter.

To follow up the intricacies of wireless telegraphy there can be no better method than to build an apparatus and make the additions from time to time as they are published in the Scientific American. To telegraph a mile or so without wires by what is known as the etheric wave or Hertzian wave system is not difficult; indeed, the apparatus required is but little more complicated than the ordinary Morse telegraph, and is so simple that the reader need have no difficulty in comprehending every detail; if on the other hand, one wishes to work out the theory involved, it becomes such a difficult task that the master physicists have yet to solve it. It is the practical and not the theoretical side of wireless telegraphy we have to deal with here.

The instrument that sends out the waves through space is termed the transmitter, and this I shall first describe. It consists of an ordinary induction or Ruhmkorff coil (see Fig. 1) giving a half inch spark between the secondary terminals or brass balls. Such a coil can be purchased from dealers in electrical supplies for about $6. A larger-sized coil may, of course, be used, and to better advantage, but the cost increases very rapidly as the size of the spark increases; a half-inch spark coil will give very good results for a fourth to half a mile over water, and the writer has transmitted messages a mile over this sized coil.

Having purchased the coil, it will be found necessary to supply the oscillators, as the brass balls are termed, since coils of the smaller size do not include them. The brass balls should be half an inch in diameter and solid; they may be adjusted to the binding posts of the secondary terminals by brass wires, as shown in the diagrammatic view, Fig. 2. It will require two cells of Bunsen battery to operate the coil, or three cells of Grenet or bichromate of potash battery will operate it nicely. An ordinary Morse telegraphic key is connected in series with the battery and induction coil, as shown in the diagram. Now when the key, 4, is pressed down, the circuit will be opened and closed alternately—like an electric bell—by the interrupter, 2, and a miniature flash of lightning breaks through the insulating air-gap between the balls or oscillators, 5, and this spark or disruptive discharge sends out the etheric waves into space in every direction to a very great distance.

The oscillators should be finally adjusted so that not more than an eighth of an inch air-gap separates them. The reason the distance between them is cut down from a half to an eighth of an inch is because in wireless telegraphy it has been found that a "fat" spark emits waves of greater intensity than a long, attenuated one. The balls are termed oscillators, since, when the electric pressure at the balls becomes great enough to break down the air between them, the electric wave oscillates or vibrates very much as a string of a musical instrument oscillates when struck; in other words, it vibrates back and forth, very strongly at first, growing lesser until it ceases altogether.

The coil and key may be mounted on a base of wood 8 inches wide by 17 inches long and ¾ inch thick (Fig. 1). This, with the battery, constitutes the wireless transmitter complete, with the exception of an aerial wire leading upward to a mast 30 or 40 feet high, or the wire may be suspended outside a building. At the upper end of the wire a copper plate 12 inches square should be soldered; this is the radiator, and sends out the waves into space; another wire, 8, leading from the instrument is connected with a second copper plate, 9, buried in the earth. The wires are then connected to the oscillators—one on either side, as shown in Fig. 2, 6,6. The aerial and earth wires may be soldered to a bit of spiral spring, as this forms a good connection and one that can be readily removed if necessary. The transmitter may be set on a table or other stationary place, but for convenience it is well to have the coil and key mounted on a separate base.

To the receiving device there are more parts than to the transmitter, and to simply gaze upon the cut, Fig. 3, it would be almost impossible to obtain a correct idea of the connections. To the layman the most mysterious part of the whole system of wireless telegraphy is the most simple and the easiest understood. I refer to the coherer. Fig. 4 is a diagrammatic view of an

experimental coherer, one that is suitable for the set in hand, for it is inexpensive, easy of adjustment and quite sensitive. A coherer, reduced to its simplest parts, consists of two pieces of wire, brass or German silver, 1-16th inch in diameter, forced into a piece of glass tubing, with some silver and nickel filings between the ends of the wire at the point, 7.

The brass standards shown, 1, in Fig. 4, together with the set screws and springs, are merely adjuncts attached to the coherer wires to obtain the proper adjustment and to then retain it. The filings may be made from a nickel five-cent piece and a silver dime, using a coarse file. The amount of filing to be used in the coherer can be roughly estimated by having the bore of tube 1-16th of an inch in diameter, and after one wire plug has been inserted, pour in enough of the filings to have a length of 1-16th inch. Before describing the function of the coherer, it will be well to illustrate the connection of the relay, tapper, sounder and coherer, and batteries. As shown in Fig. 3, the tapper—the central instrument back of the coherer—is improvised from an old electric bell, the gong being discarded. The relay, on the right, should be wound to high resistance, about 100 ohms. It is listed as a "pony relay," and like all other parts of the apparatus except the coherer, it may be purchased of any dealer in electrical supplies. The sounder, on the left, is an ordinary Morse sounder of 4 ohms resistance. The tapper magnets should be wound to 4 ohms. All should now be mounted on a base 10 by 16 inches and connected up as the diagram, Fig. 5, illustrates; that is, the terminals of the coherer are connected in series with two dry cells, 2, and the relay, 3. From the relay a second circuit, also in series, leads to the tapper, 6, thence to a battery of three dry cells, 5, and on to the sounder, 4, and finally back to the relay, 3. This much for the two electric circuits. The puzzling part to the novice in wireless telegraphy lies in the wires, 7 and 8, branching from the coherer. These have nothing to do with the local battery circuits, but lead respectively up a mast equal in height to the one at the transmitting end and down in the ground, as before described. These are likewise provided with copper plates. As shown in the engraving, Fig. 3, the connections are all made directly between the relay, coherer, sounder, tapper, and batteries for the very sensible reason that they are connected together with a deal less trouble than by the somewhat neater method of wiring under the baseboard. This, however, is a matter of time, taste and skill.

Now let us see what the functions of each of the appliances constituting the receiver are, their relation to each other, and finally, as a whole, to the transmitter a mile away. To properly adjust the receiver to the transmitter it is well to have both in the same room—though not connected—and then test them out. The relation of the coherer to the relay and battery circuit may be likened to that of a push-button, the bell and its battery. Coherer and push-button normally represent the circuit open. When one pushes the button, the circuit is closed and the bell rings; when the Hertzian waves sent out by the distant transmitting coil reach the coherer, the particles of metal filings cohere—draw closer together—thus closing the circuit, and the relay draws its armature to its magnets, which closes the second circuit, and then the tapper and sounder become operative.

The purpose of the tapper is to de-cohere the filings after they are affected by the etheric waves each time, otherwise no new waves would manifest themselves. The relay is necessary, since the maximum and minimum conductivity of the coherer, when normal and when subjected to the action of the waves, is not widely divergent, and therefore an appliance far more sensitive than an ordinary telegraphic sounder is needed; this is provided by a relay, which, while being much more sensitive, has the added advantage of operating a delicately-poised lever or armature instead of the heavy one used on the sounder. Signals can be read from the tapper alone, but to produce dots and dashes—the regular Morse code—a sounder is essential.

The adjustment of the coherer and its relation to the relay is not as difficult as the final adjustment of the sounder and tapper, but if the following rules are adhered to carefully, the result will be a successful receiver.

First arrange the adjusting screws of the relay armature so that it will have a free play of only 1-32d of an inch, when the armature is drawn into contact with the second circuit connection, just clearing the polar projections of the magnets; have the

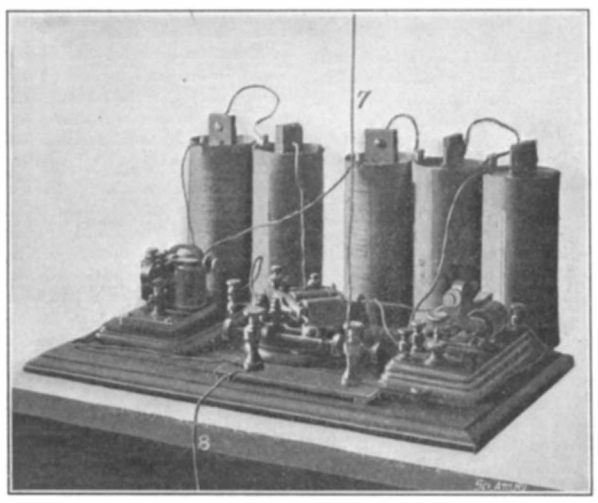
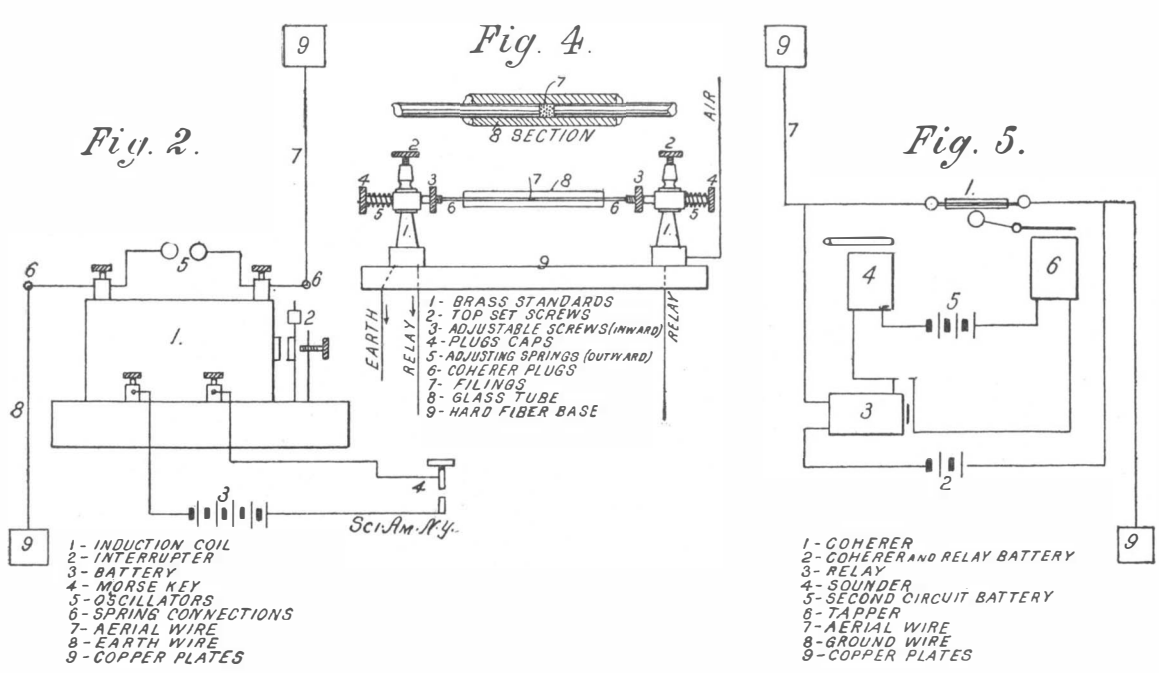


Fig. 3.—SET OF RECEIVING APPARATUS FOR WIRELESS TELEGRAPH.

tension of the spring so that it will have only "pull" enough to draw back the armature when there is no current flowing through the relay coils. Now connect the two dry cells in series with the coherer, Fig. 5. Unscrew one of the top set-screws, 2, Fig. 4, and then screw up the inner screw, 3, until the current begins to flow through the circuit and pulls the armature of the relay to the magnets. Tap the coherer with a pencil while turning the screw of the coherer to prevent premature cohesion, which is apt to occur by pressure. When absolute balance is secured between the coherer and the relay, connect in the battery of the second circuit, which includes the tapper and the sounder. When the relay armature is drawn into contact, closing the second circuit, both the tapper and the sounder should operate, the former tapping the coherer and the latter sounding the stroke. The adjustment of the sounder requires the most patience,



DIAGRAMS OF WIRELESS-TELEGRAPHIC APPARATUS.

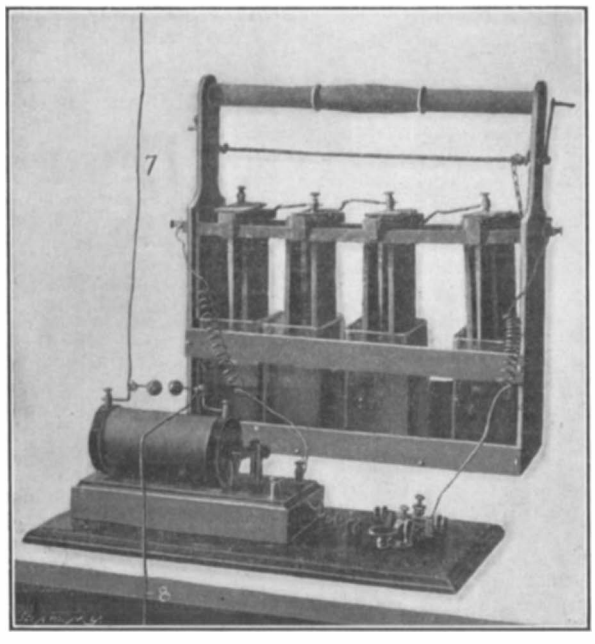


Fig. 1.—CHEAP RUHMKORFF COIL GIVING ½-INCH SPARK.

for it is by the most delicate testing alone that the proper tension is obtained. This is done by the screw regulating the spring attached to the sounder lever.

When all has been arranged and the local circuit of the transmitter is closed, the spark passes between the oscillators, waves are sent invisibly through space by the aerial and earth plates, and radiating in every direction, a minor portion must come into contact with the receiving aerial and ground plates, where they are carried by conducting wires to the coherer, and, under the action of the waves, the filings cohere, the relay circuit is closed, drawing the armature into contact, closing the second circuit when the tapper operates, striking the coherer tube and de-cohering the filings; at the same time the lever of the sounder is pulled down, and, by the law of inertia, it will continue to remain down, if a succession of waves are being sent by the transmitter, assuming the key is being held down, producing a dash, notwithstanding the tapper keeps busily at work de-cohering in response to the continuously closing circuit caused by the waves; but the sounder—sluggish in its action—when once drawn down, will remain so until the last wave is received and the tapper de-coheres for the last time, finally breaking the second circuit for a sufficient length of time to permit the heavy lever to regain its normal position.

All these various actions require a specific time in which to operate, and so the transmitting key must be operated very slowly, each dot and dash being given a sufficient length of time for the passage of a good spark. With the Marconi, Slaby, Guarini and all other systems of wireless telegraphy now in use, only twelve to fifteen words per minute can be sent. It is also well to remember that the higher the wires leading up the mast are, the further the messages will carry. Wireless transmission over water can be carried to about ten times as great a distance as over land.

Wireless telegraphy is very much like photography and everything else worth knowing. To know it well requires care, patience and practice, and the more one keeps everlastingly at it, the greater the results will be.

The Building Edition for September.

The Building Edition for September, 1901, is filled with beautiful engravings and excellent reading matter germane to the scope of the periodical. In addition to a number of artistic houses the Japanese garden of Mr. Nathan F. Barrett is illustrated and described, as well as some of the architectural features of San Francisco's cemeteries. The editorial is entitled "The Attractiveness of the House." There is the usual interesting "Monthly Comment" and "Household Notes." The eighth in the series of "Talks with Architects" is with Mr. S. B. P. Trowbridge on the "City Apartment House and Hotel." The other departments are "New Books," "With Our Correspondents," "New Building Patents," and "Legal Decisions."

The Current Supplement.

The current SUPPLEMENT, No. 1341, contains many beautiful illustrations. The first page engravings show the volcano of Ætna, including the crater. "How to Interpret the Facts of Geology" is a lecture by Prof. Angelo Heilprin. "Sven Hedin's Exploration in Central Asia" is a most graphic description of remarkable travels. "The Progress of Science" is an address of the retiring president of the American Association for the Advancement of Science at the Denver meeting. "The Scale Insects and Mite Enemies of Citrus Trees" is a most interesting article, accompanied by a number of engravings showing the treatment of the orange and other trees by various means. "How Arctic Animals Turn White" is by R. Lydekker. "Electrically-Operated Pumps" is by F. C. Perkins and is accompanied by a number of illustrations.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

RATCHET PLOW-STOCK. — THOMAS M. WALLACE, Marion, Ala. The invention is an improvement in shovel-plows having a foot pivoted and adapted for adjustment to vary the depth of the furrow made by the shovel. In the present invention the ratchet on the beam is curved concentrically with the pivot of the foot, and a pawl is pivoted to the top of the foot and is provided with a prong which engages the ratchet. A second prong projects forward over the first. The pawl can be secured and clamped whenever it may be desired to effect a forward adjustment of the foot, and can be used with either prong down.

Apparatus for Special Purposes.

APPARATUS FOR RENDERING WATER PURE AND PALATABLE.—JOHN S. WRIGHTNOUR, Oil City, Pa. The inventor employs a boiler, the vapors from which are led through a filter of highly-absorbent charcoal or similar deodorizing material and thence to a peculiarly-arranged condenser, in connection with which pure, cold air, rich in oxygen, is employed. The water of condensation is introduced into a chamber in which such air is contained for the double purpose of cooling the water and thoroughly aerating it with the oxygenated air.

SCREEN-CLEANER AND STUFF-REGULATOR. — ROBERT M. HAWK, Warren Papermills, N. J. In papermaking the pulp is first run through a screen to free it from dirt. The pulp settles on the screen-plates and becomes irregular, thereby causing the finished sheet of paper to be uneven and not of uniform thickness. This difficulty is obviated by Mr. Hawk by providing in the screen-box a device with means to move it back and forth on the screen-plates so as to clean the screen and cause the water and pulp to feed through the screen uniformly.

GAME APPARATUS. — DUNCAN MCRUER, Pauls Valley, Indian Territory. The game apparatus is of that type in which marbles or other rolling objects are propelled by players with the object of hitting targets. In this instance the targets represent nations or countries. The game apparatus which is described in this patent is so constructed that besides affording amusement it will require considerable skill.

DEVICE FOR CLEANING SHIPS' BOTTOMS.—JAMES C. MIDDLETON, East Palatka, Fla. This device comprises a tube of flexible material closed at the lower end, glass being inserted in one wall of the tube at the lower portion. Supporting frames are connected with the tube, each consisting of pivotally-connected sections. The workman lowers himself into the tube, and is free to remove barnacles and other foreign matter. The device can be moved along the hull of the vessel to meet the requirements of the workman.

APPARATUS FOR PRODUCING BISULFITE LIQUOR.—GEORGE A. STEBBINS, Watertown, N. Y. The purpose of this invention is to provide means for producing the bisulfite liquor used in paper manufacture, by which the product will be obtained more economically and effectively than heretofore. This end is attained by insuring the intimate contact of the sulfurous gases with a basic solution and also gradually cooling the sulfurous gases.

Vehicles, Stable Appliances, Etc.

MOTOR-CARRIAGE. — ALBERT S. PARSONS, Sierraville, Cal. The inventor has been concerned with providing improvements whereby the turning of one truck will properly operate the other. He has perfected a means for transmitting the driving power from one truck to another, and likewise the construction of the truck itself. The invention provides means for driving the axles of both trucks and furnishes means for guiding one truck by the other.

HORSESHOE.—MICHAEL HALLANAN, Manhattan, New York city. Mr. Hallanan, who is the inventor of the well-known Hallanan rubber pads for horses, has in this invention embodied a novel manner of constructing the shoe at the quarters and also a novel front section. The tread of the shoe at the quarters is formed of rubber or the like, on a leather base or backing in a manner to permit variation of the lines of the shoe. It has always been a matter of some difficulty to fit the quarters to the hoof. Horseshoers impoverish the hoof at the quarters by attempting to pare the hoof to fit the shoe. Mr. Hallanan has provided in his invention a means for the adjustment of the shoe to the particular lines of the hoof.

HORSESHOE-SHAPING DEVICE. — MICHAEL HALLANAN, Manhattan, New York city. The invention provides a tool wherewith horseshoers may expand or contract a horseshoe at the quarters to fit the peculiarities of the hoof. As we have remarked in the foregoing notice the greatest difficulty is experienced in fitting a horseshoe at the quarters. Although the invention is useful with horseshoes in general, it has special advantages in connection with the improved shoe described in the foregoing notice.

QUICK-TURNING VEHICLE GEAR.—BUCK MASON, Trenton, Mo. The front and rear axles are rigidly connected by a reach-bar. Stub-axles are provided with spindles, arms being arranged at an angle to the spindles. Bolts are passed loosely through the ends of the front axle and engage the arms, thereby rigidly connecting these arms with the stub-axles and also pivoting the stub-axles to the ends of the front axle. A laterally-rockable lever is pivoted upon the reach-bar, and rods connect the lever with the arms on the stub-axles. This running gear permits the turning of the gear and vehicle in a small circle or arc.

WHIFFLETREE.—ABRAHAM C. SCARR, Harriston, Ont., Can. This improved whiffletree is mainly constructed of metal bars so combined and arranged as to afford a very light, strong and durable pull-bar for a vehicle. The construction is inexpensive and can be varied in dimensions to suit the service it is to perform.

HORSE-DETACHER.—LEON DE W. HOWARD, Blunt, S. Dak. The invention relates to improvements in devices for detaching runaway horses from a vehicle. The device comprises a latch mounted to swing on a pole. A lever pivoted to the vehicle is arranged to engage with the free ends of the latch to hold it in closed position around the evener. A spring extends from the lever to a fixed portion of the vehicle. By moving the lever out of engagement with the latch, the latch will fall downward and release the evener.

Railway Contrivances.

RAILROAD TRACK.—CHARLES H. MCDERMOTT, 104 So. 15th Ave., E. Duluth, Minn. Broad flat sleeper-plates are provided at their opposite edges with rows of depending teeth. Rail-holding plates and rail-joint plates are bolted at one edge to the sleeper-plates and lapped at the other edge upon the bases of the rails. The tie connections are composed of cross-bars extending beneath the opposite sleeper-plates. End brackets are socketed to receive and are bolted to the cross-bars, flattened portions being provided which lap upon the sleeper and rail holding plates. By this invention the tie-bars operate to hold the opposite sleeper-plates in position and prevent any spreading of the rails. The necessity of using spikes is avoided; for all the parts are bolted together.

FUSE-HOLDER.—WARREN R. COOK, Pittsburg, Pa. The invention relates to improvements in fuse-wire holders, for electric street-cars. The object is to provide a holder of simple construction having a number of fuse-wires, so that should one be burned out a new one can be quickly turned into place to complete the circuit.

STATION-INDICATOR.—PAUL P. I. FYFE, Concord, N. C. The inventor has devised a station-indicating device for steam, trolley, and cable cars, which device is so constructed that in conjunction with trips or stops located upon a track, cards bearing the names of streets, crossings, avenues, or stations will be automatically displayed within the car when such streets or stations are reached. The mechanism by which these results are obtained can be attached to any car, and is durable and economic in its construction.

STATION-INDICATOR.—PAUL P. I. FYFE, Concord, N. C. The present invention is an improvement upon the device described in the foregoing notice, the construction being so modified that instead of the designs or display cards being shifted vertically to bring them to a display position, the cards or signs will be moved or slid laterally from a storage position to the display position and return. The mechanism is operated by a trip-shoe which is to be brought in contact with pins or other projections adjacent to the rail of the track.

NUT-LOCK.—WILLIAM H. TIPPIT, Bluffs, Ill. The nut-lock comprises a peculiarly-formed disk arranged to connect with a bolt so that the disk cannot turn on the bolt, and also arranged to be engaged by the nut in such a manner as to hold the nut securely on the bolt. The disk acts effectively on the nut owing to its form and the manner in which it is mounted on the bolt.

Miscellaneous Inventions.

SUSPENDER-END.—LEWIS E. PEASE, Bronx, New York city. The suspender-end is arranged to receive and conceal a button of the trousers. The suspender-end consists essentially of a pocket which receives the button.

GARMENT.—JEREMIAH C. LAUTENBACHER, of Schuylkill Haven, Pa. The garment is a union suit of improved construction. The object of the invention is to enable the front and back portions of the lower half to be readily opened and closed.

DRILL.—THEDE P. BLAKE, of Lamar, Neb. The invention is a drill or auger for earth and rock, and comprises a body, bearing bits set at an inclination and arranged to cut the earth or rock. A plunger works with the body portion and is given a rotary movement by an arrangement of threads on the two parts, so that when the plunger reaches the end of its movement and engages the body of the drill its momentum will partly turn the drill and cause the bits or tools to work.

METHOD OF PRESERVING WOOD.—ANDRIES BEVIER, Manhattan, New York city. The wood is first subjected to a heat of 212 deg. F. and upward without pressure, thereby evaporating moisture and drying the wood. The temperature is then raised from 250 to 500 deg. F. and an air pressure from 100 to 200 pounds is applied sufficient to prevent the loss of volatile material from the wood by further evaporation, thereby retaining in the wood such antiseptic materials as may be formed by the action of heat upon the fluids of the wood and diffusion of resinous matter, which upon cooling solidifies and hermetically seals the pores. The result of this treatment is to sterilize the wood thoroughly, coagulate the albuminous material of the sap, diffuse the resin, and harden the timber. Antiseptic liquid is subsequently introduced, which on account of its great viscosity (since it contains creosote oil) is very refractory to ordinary impregnation treatment.

ACETYLENE-GAS LAMP.—WILLIAM F. COOPER, Meriden, Conn. In this lamp the variation in volume of the gas-chamber is provided for by having a portion of the wall constructed of a flexible material compressed by means of a spring. The use of the flexible connection between the carbid-holder and the base thus forms a bellows and provides for the expansion and contraction of the gas-containing chambers without necessitating a liquid seal. This is a matter of considerable importance in bicycle lanterns.

LAMP-WICK.—HENTIER SARAFIAN, Manhattan, New York city. The invention belongs to that class of wicks in which a wick proper of the usual material is combined with an incombustible tip held in place and firmly connected with the wick proper by a stiff cap embracing the tip and the top of the wick. The object of the present invention is to provide an improved connection of the cap with the wick without the use of any additional parts.

CLOSET-BOWL.—FRANCIS X. L. GOSIENIECKI, Manhattan, New York city. A cuspidor is attached to the bowl, water being admitted to the cuspidor when the bowl is flushed.

DENTAL IMPRESSION-CUP.—JOHN W. FOWLRING, Albia, Iowa. The invention is a dental cup for taking impressions of the lower jaw. The device is characterized by a movable wall or walls, specifically the inner walls, by which a better impression of the gums can be obtained than was heretofore possible.

Designs.

BROOCH.—ALBERT WITTNAUER, Manhattan, New York city. The main feature is an ornamental body having depending spaced side arms and an apertured bearing between the arms.

HAIRPIN.—WALTHALL R. SMITH, Napa, Cal. The hairpin is so constructed that the lower ends of its two members will interlock so that the hairpin cannot fall from the head.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

BY LAND AND SKY. By the Rev. John M. Bacon, M.A., F.R.A.S. Philadelphia: J. B. Lippincott Co. 1901. Pp. 275. 4 illustrations.

This volume is full of fascinating accounts of the author's ballooning experiences. The history of ballooning and the men who have made it are graphically portrayed, and many of the narrow escapes of the author and others recounted most interestingly.

THEORETICAL ELEMENTS OF ELECTRICAL ENGINEERING. By Charles Proteus Steinmetz. New York: Electrical World and Engineer, publishers. 1901. 8vo. Pp. 327. Price $2.50.

The author has restricted the work to the forms of apparatus which have shown themselves to be of practical importance, and gives only those methods and theories which an extended experience in the design and operation has shown as of practical utility. The author has illustrated his volume freely with diagrams and curves. The book is an important one for those who are interested in the theory as well as the practice of electrical engineering.

GASOLINE MOTOR VEHICLE. C. C. Bramwell. New York: Emil Grossman & Co. 1901. 8vo. Pp. 149.

There is a great demand for a work of this kind at the present day, when the motor carriage is becoming so popular. The motor and its appendages seem to be of excellent design. The working drawings are numerous and are lettered with dimensions. With the aid of this book any good mechanic ought to be able to construct a gasoline motor carriage.

PRACTICAL POINTERS FOR PATENTEES CONTAINING VALUABLE INFORMATION ON THE SALE OF PATENTS. By F. A. Cresee, M.E. Cumberland, Md.: Potomac Publishing Company. 1901. 16mo. Pp. 152. Price $1.50.

When a patent is allowed or issued, the patentee's real work begins, and here the work of the reputable patent attorney should end. The business end of the inventor's work should be undertaken by himself or under his immediate supervision. The object of this little work, based upon the experience and observation of the author and other successful inventors, is to give the patentee such information and advice as will enable him to proceed more intelligently on the most successful and economical basis to realize from his invention.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

Inquiry No. 1320.—For the name of the manufacturer of the telephonic diaphragm measuring apparatus.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 1321.—For manufacturers of salt cellars and other dredging uteusils.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1322.—For the latest patent barrel bung machine.

Gasoline Lamps and System, Turner Brass, Chicago.

Inquiry No. 1323.—For manufacturers or dealers in broom winders.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 1324.—For manufacturers or dealers in packing for cold water pipes.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1325.—For manufacturers of small ice machines of two or three hundred pounds capacity.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 1326.—For manufacturers of flat coil spring motors.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1327.—For parties to make castings in black glass.

If making metal goods and needing special parts, write us. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 1328.—For a small electric light machine run by a gas engine with sufficient power to light a large theater.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

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SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

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Inquiry No. 1331.—For a machine to roast or calcine oxide of iron.

Kester Electric Mf'g Co's, Self-fluxing solder saves labor, strong non-corrosive joints, without acid, Chciago, Ill.

Inquiry No. 1332.—For telephones for private use.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1333.—For electric storage batteries for power and light.

INVENTORS, ATTENTION!—Incorporate your companies in South Dakota, Charter fee, $10. Laws most liberal in United States. Address Box 6, Pierre, S. D.

Inquiry No. 1334.—For dealers in "Wimshurst Static Electrical Machines."

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1335.—For manufacturers of "jockey hold-back" work harness, also jockey neck yokes.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1336.—For the address of the toy gas engines "Paragon" and "Weedens."

SUPERINTENDENT WANTED.—Manufacturer of electric and steam railway novelties wants an experienced superintendent, capable of running works employing about two hundred men, principally iron workers. Must have knowledge of mechanical engineering. State salary, experience and age. Correspondence confidential. Address A. B., care SCIENTIFIC AMERICAN, 443 The Rookery, Chicago.

Inquiry No. 1337.—For manufacturers of small gasoline motor castings of ¼ or ⅙ horse power.

A NATURAL BIOGRAPH.—The trip from New York to Buffalo gives one a magnificent panorama of scenery unsurpassed by any railroad line in America, especially because the locomotives on the Lackawanna Railroad burn hard coal, emitting no smoke, and the roadbed is stone ballasted, producing no dust. Meals are served during the entire day on the á la carte plan, so you pay only for what you eat. A good road to remember for the Pan-American Exposition.—American Journal of Education.

Inquiry No. 1338.—For manufacturers of castings for small model steam engines, also of supplies for small boilers.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 1339.—For parties dealing in small engine castings and blue prints from which to build engines.

Inquiry No. 1340.—For manufacturers of air compressors, drills, saws, etc.

Inquiry No. 1341.—For Brooklyn, Philadelphia and French sand used by brass moulders.

Inquiry No. 1342.—For manufacturers of pearl botton machinery.

Inquiry No. 1343.—For machines and apparatus for burning crude oil for domestic purposes.

Inquiry No. 1344.—For manufacturers of paper board letter stencils for sign makers; different sizes of alphabet and designs preferred.

Inquiry No. 1345.—For manufacturers of waterproof cardboard signs.

Inquiry No. 1346.—Fer manufacturers of advertising novelties.

Inquiry No. 1347.—For dealers in second-hand gasoline engines.

Inquiry No. 1348.—For the manufacturers of "Kitchen Ice Machine."

Inquiry No. 1349.—For dealers in copper and aluminium wire.

Inquiry No. 1350.—For manufacturers of transfer picturers for use on furniture.

Inquiry No. 1351.—For a tree-stump pulling machine.

Inquiry No. 1352.—For manufacturers of cork machinery.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8349) L. K. asks: We want to build a 2 or 3 horse power motor to run a lathe, etc., on a 500 or 110-volt current, and can find no such machine described in your index. Can you let us know where we could obtain such a description? A. We can furnish you a book called "Electrical Designs," price $2 by mail, which contains the sort of machine you wish.

(8350) W. E. H. writes: In reference to the electrical ignition on the gas engine described in the book, "Gas Engine Construction," by Parsell and Weed, I would like to ask the following: What would be the objection to connecting one of the wires of the primary circuit (on page 230 of above-named book) direct to some part of the engine, and making the pin, which projects from the hub, of steel, the spring, *e*, remaining insulated from the rest of the engine? It seems to me that the platinum ends of the spring could then be dispensed with, as the surfaces would remain bright and contact assured by the continual rubbing. A. The sparking break device described is in use with good results, but the use of steel surfaces subjects the contact points to wear, which may change the ignition time. There is no objection to the method of connection; but we advise the use of platinum contact points on both pin and spring.

(8351) H. R. asks: Have you one or more SUPPLEMENTS showing the construction of a simple electric motor that could be run with the power from an incandescent light wire. A. We have no plans for motors to be run upon a lighting circuit with 110 volts in our SUPPLEMENTS. You will find such in the book "Electrical Designs," which we can send for $2 by mail.

(8352) L. D. asks: Would like to know through your paper if the engineering courses are reliable which are advertised by the correspondence schools. Can a graduate of either of the courses satisfactorily fill a position as engineer? A. We must say in response to your inquiry that it is not the school which makes the successful engineer, but the student. A good school cannot make a successful man of a poor student; and a poor school will make a successful man of a good student. There are many unsuccessful men who have the diploma of our highest universities, and there are great men who, when they give the name of their college, have to tell you where it is. You never heard of it. It is so unknown. We esteem the school you name as very good of its kind. If your circumstances only allow you to take correspondence work you can do well through this school.

(8353) J. E. M. writes: I am interested in an organization which meets in a hall the acoustics of which are very unsatisfactory. The size of same is about 60 x 35, and about 15 feet high—a square room. Can you advise any way by which the acoustics could be improved? If you can favor me in any way in this respect you will not only confer a favor, but will do us a great deal of good in our work. We thank you in advance. A. This difficulty has been recently the subject of a note in these columns. Please refer to Query No. 3334 for directions how to proceed to remedy your difficulty.

(8354) H. F. M. asks: 1. Which of the two formulas, MV^2, or $\frac{1}{2}MV^2$, expresses the kinetic energy of a moving body, M being its mass and V^2 the square of the velocity? A. $\frac{1}{2}MV^2$. 2. What is the exact equivalent of the grain in fractions of the gramme and vice versa? A. One grain equals 0.0647989 gramme. One gramme equals 15.43234874 grains. These are exact to 7 and 8 places of decimals, but it is not necessary to be so exact. It is not common to go below four places of decimals. 3. Give me the correct chemical formula of picrate of potassium. A. $KC_6H_2(NO_2)_3O$. 4. How is the power of an explosive to be figured out from its formula? A. By finding the number of volumes of gas which can be produced by the combustion of the substance. This, at 15 pounds per volume, gives the pressure.

(8355) C. C. A. asks: 1. Is there any acid in which tin will dissolve? A. Tin dissolves readily in hydrochloric acid, slowly when boiled in dilute sulphuric acid; also in concentrated sulphuric acid with different reactions from what takes place in the dilute acid, and in dilute nitric acid. Acetic acid (vinegar) slowly dissolves the tin from the dishes in the kitchen. 2. Any in which aluminium will dissolve? A. Hydrochloric acid dissolves aluminium, even when the acid is dilute. Sulphuric acid, when hot and diluted with water up to 3 or 4 parts, will dissolve it. So does nitric acid when concentrated and boiling. 3. Do you know of any firm selling coherers, separate (for wireless telegraphs)? A. Probably any dealer in physical apparatus can supply you. 4. Have you any SUPPLEMENT containing the Hertzian wave theory, and his apparatus, such as transmitter and receiver? If so, what number? A. We have just published a valuable article upon "Electric Waves" in SUPPLEMENTS Nos. 1318, 1319, and 1320, price ten cents each. Also one upon "Wireless Telegraphy" in SUPPLEMENTS Nos. 1328 and 1329, price ten cents each. These deal with "Hertzian Waves." Wireless telegraphy has developed since the lamented death of Prof. Hertz. There is probably very little, if any, apparatus which he designed in use at the present time.

(8356) A. T.: Machine cut nails were first made in Providence, R. I., in 1775 and improved during the last years of the eighteenth century. The first cast-iron plow-share was made in New Jersey in 1797.

(8357) C. L. G. asks: Can motor described in SUPPLEMENT No. 759 be run as a dynamo? If so, how many 16-candle-power lights will it burn? Please let me know what changes would be necessary to make it a dynamo? A. The little motor of SUPPLEMENT No. 759 is run by 4-6 cells of plunge bichromate battery. If it would generate as a dynamo upon running it by power you would get nearly the same current as the battery would give. No changes are needed to make it into a dynamo. It may not, however, generate at all as a dynamo. It is a very little machine. It will not light a 16-candle-power lamp. It has not voltage enough.

(8358) C. R. B. asks: 1. What do you consider the best soldering flux for soldering electric wires, outside and inside? A. Rosin is the best flux for soldering copper or iron. Next to that, and much easier of use, is some one of the soldering pastes which can be had from dealers in electric light supplies. 2. In any certain dynamo upon what will the voltage of that machine depend—speed of armature, strength of field, or both? If the latter, will the strength of the field depend upon the current passed through it? A. The voltage of a dynamo is determined by the rate at which lines of force are cut—100,000,000 lines cut per second produces one volt. One ampere-turn produces one line of force. The number of turns of wire upon the field magnets multiplied by the number of amperes flowing through the field circuit gives the number of ampere turns of the field. The number of turns on the armature active at one time multiplied by the number of revolutions per second gives the number of times a line of force of the field is cut per second. The product of the number of lines of force by the number of times a line is cut per second divided by 100,000,000 gives the voltage. Hence, the voltage of a dynamo depends upon the number of turns in the field, the current which flows through the field, and the speed of the armature and the number of turns of wire upon the armature. 3. What is the chief difference between a Bell telephone and the independent 'phones? A. Anyone may make apparatus upon which the patent has expired. The fundamental patents upon the telephone expired some time ago. Patents upon many minor parts of the telephone are still in force. Whoever owns such a patent can enforce it. Most makers of telephones have some part of their instruments covered by a patent; other parts are common property owing to the expiration of the patent covering that part. We are not able to specify any chief difference between one telephone system and another. 4. Can you give me a scientific reason for the following phenomena: In our country the surest sign of an approaching rain is that springs will begin to run and the creeks will begin to ooze water. It is a peculiar, but sure sign. A. This is certainly a peculiar sign. We have heard people maintain it before, but see no reason for it. 5. Fuses for telephones, etc., are marked thus: ¼ ampere, etc. Does that mean they will burn out at ¼ ampere, or that they will carry no more than ¼ ampere? A. A fuse is rated at the current it will carry with safety. Most fuses will stand overload without melting. Some have been found to carry double the load they were marked to carry. Much depends upon the exposure to the air. If a fuse has a current of air passing over it, it will not heat as much as if it were in a closed place.

(8359) N. J. F. asks: Have two alternating-current fan motors. If they can be run on direct current kindly let me know. A. To run a fan upon a direct current requires a commutator upon the shaft of the armature in place of the rings which are to be found there when the motor is to run with an alternating current.

(8360) G. T. F. asks: Will you kindly inform one of your interested readers if there is any chemical or chemicals more sensitive in changing color through the different stages of the atmosphere than cobalt chloride, and what it is? A. Other salts of cobalt possess the same property.

(8361) A. D. asks: I desire to make a small alternating-current induction motor of about ⅛ horse power and would like some information on how the field is wound, how the armature is made, etc. Can you give me the desired information in the SCIENTIFIC AMERICAN? A. The plans for a small single-phase induction motor are to be found in the book of "Electrical Designs" recently published, which we can send you for $2 by mail. You will find this a very valuable work.

(8362) P. W. B. writes: 1. How great a pressure can be raised safely by either naphtha or gasoline? (Not by exploding them.) A. Any pressure that a vessel or tube will bear within its factor of safety from rupture, can be applied to naphtha or gasoline without fear of explosion or increase of pressure by change in the constituents of the fluids. 2. If 5 or 6 parts of air accidentally get mixed will the danger from an explosion at three-fourths the limits for pressure and temperature amount to anything? A. There is no danger of explosion from naphtha vapor and air mixture at any pressure, if temperature is below 400 deg. F. Sudden compression to 200 pounds is dangerous, because the heat of compression raises the temperature to 650 deg., at which the mixture becomes spontaneously explosive. 3. What per cent of air will mix safely with the gas for the limit of temperature and pressure, and also for three-fourths the limit? A. One part gas to 4 parts air and 1 part gas to 15 parts air are not known to be explosive. Any mixture between those above named is uncertain as to the limit of temperature of ignition. We know of no experiments as to the limiting temperatures and pressures. 4. Can the pressure be raised to 1,200 pounds, with naphtha or gasoline? A. Yes, any pressure for the liquid and also for the vapor, which will condense at very high pressure only, with moderate temperature. 5. Will the gas alone of naphtha or gasoline contained in an air-tight vessel explode if the temperature gets too high? What will happen then? A. Gas or vapor alone will not explode at high temperature; at red heat the vapor will be converted into a permanent gas, and like any other hydro-carbon gas will burn in the atmosphere or become an explosive when mixed in the proper proportions with air. 6. If an explosion occurred by mistake how great a pressure would probably be created? A. About 300 pounds per square inch if not under great compression previously. Add the previous compression to 300 pounds for the initial force of explosion. 7. What heat will copper tubing (1 inch inside diameter, of standard thickness) stand before weakening? A. About 700 deg. F. 8. If there is from 400 to 500 pounds pressure inside the tubing, what will be the limit of safety as to heat? A. About 700 deg. F. for a copper tube ⅛ inch thick. 9. What is the limit of safety of both heat and pressure in the same tube at one time? A. A seamless copper tube as above should stand 1,000 pounds per square inch at 600 deg. F. and under. 10. what will be the limit of temperature said tube will stand if there is only gas in the tube at from 400 to 500 pounds pressure? A. From 700 to 800 deg. F. 11. What will be the limit of temperature said tube will stand if there is both a liquid and a gas in the same tube at from 400 to 500 pounds pressure? A. The kind of material will make no difference in regard to strength and temperature at the above pressures unless by the evaporation of the liquid a very much greater pressure is generated. The temperature limit will then be as before stated. 12. Is there a tube of any sort made which will transmit heat in great quantities and that will stand a pressure of from 600 to 800 pounds which will stand a temperature of over 1,000 deg. F.? A. We can only suggest an alloy of copper and platinum, or platinum alone. 13. Will other sized copper tubing have the same strength and qualities? A. The resistance to pressure of copper or other tubing is inversely as the diameter with equal thickness. The resistance on a tube of a given size is also nearly proportional to the thickness of the tube walls.

TO INVENTORS.

An experience of over fifty years, and the preparation of more than one hundred thousand applications for patents, at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office Scientific American, 361 Broadway, New York.

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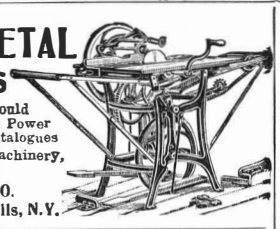

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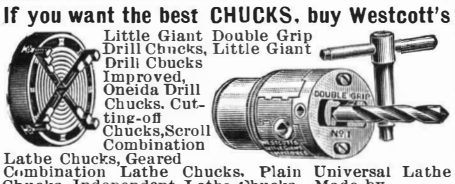

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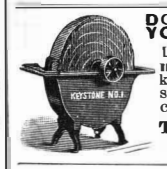

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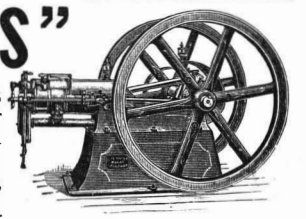

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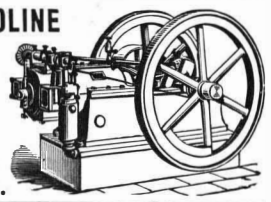

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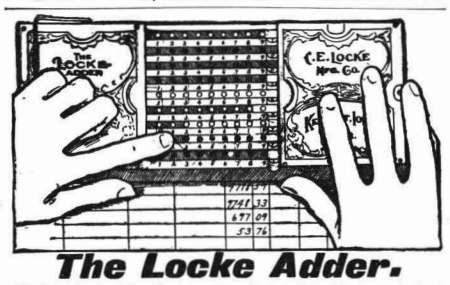

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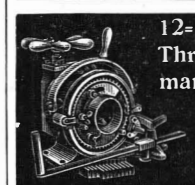

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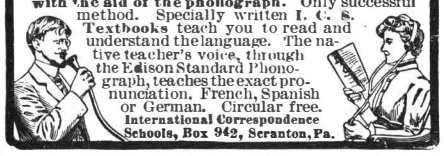

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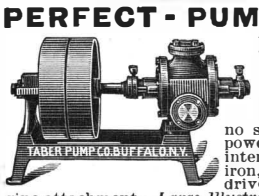

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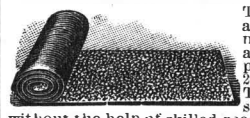

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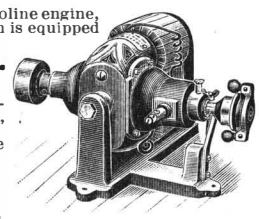

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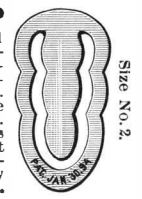

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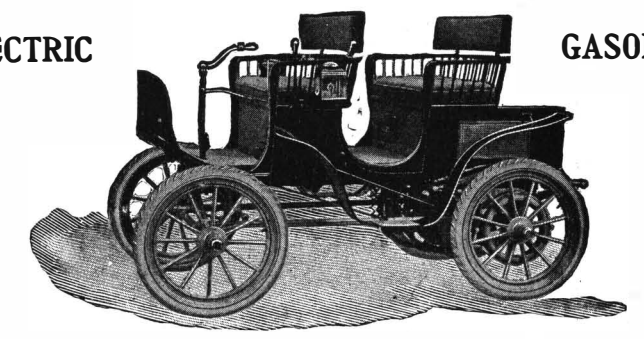

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